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"The tremendous advances in machine tool design that have been made since the war, and are still being made, lead me to set five years as the extreme limit for the life of an average machine tool. * * * In almost any shop it will pay to make the tests necessary to give the actual life of cutting tools on each job. * * * Another item that will loom large on the right side of the ledger is the scientific application of belting. It is just as important to get the power into the machine as it is to have the right machine for the job in question."

# Getting the Most Out of Your Machine Tool Dollar

By T. C. Vail

Superintendent, Spicer Manufacturing Corporation

ONE of the finest examples of false economy that I can think of is the Government tax ruling that allows a manufacturer to figure depreciation at no more than a 12½ per cent rate. Eight years of serviceable life may be a fair figure for some kinds of manufacturing equipment but any user of machine tools for real production work will not be likely to last long if he tries to get along with equipment eight years old.

The tremendous advances in machine tool design that have been made since the war, and are still being made, lead me to set five years as the extreme limit for the life of an average machine tool. I don't mean by this that the tool will be worn out for it will probably have many more years of service in it, but I do mean that it will be obsolete and that it should therefore be replaced.

In any manufacturing establishment that has survived the vicissitudes of the business world for twenty years or more there is almost sure to be a certain amount of old equipment. Some of it may have been purchased for a job that no longer holds the center of the stage but is still a money-maker and therefore worth continuing or it may be possible to rebuild it for special purpose tools. Such equipment may not be up to the minute in every particular but it may still be efficient enough to make its replacement by new machines too heavy an expense to be warranted. Under such conditions even the most enthusiastic believer in the economy of using only the most modern tools must admit exceptions to his rule. Equipment of this type, however, cannot be anything but an exception in a really efficient plant.

No matter what the condition of the equipment may be there is naturally a constant pressure from the customer for lower prices on the product. When this pressure gets to be more than the sales department can resist it is passed on to the manufacturing department in the form of a demand for better methods. When we get such a demand we take the operation sheets on the part in question and go over them, operation by operation, until we have picked out the most likely points where savings can be made. We then go to a reference file of machine tool data, kept for just this sort of an emergency. The file contains proposals, catalogs and every other form of machine tool information we know of. Its contents apply, naturally, to the kinds of tools we use in our work.

When we have selected the operations that seem most likely to yield appreciable savings we write to the builders of the machine tools we have decided to consider and get from them guaranteed figures of the production they claim on the operation to which each machine is best suited. When the bids come back we look them over and pick out the most likely ones. These, by the way, are not always the lowest ones.

With the cost of the machine and the guaranteed production figures before us we can apply to the machine the machine-hour rate type of burden used throughout the shop and thus arrive at a very close estimate of the cost per piece. If the machine will pay for itself in one year's time an order is usually placed at once. If it will not we look further because it has been our experience that if we work long enough at the job we can discover a machine and a method that will produce the desired result and meet our one-year requirement.

Right here I want to acknowledge the debt I owe to the salesmen and sales engineers of the machine tool builders and dealers. They have all played fairly with me as I have tried to play with them and have cheerfully given me the information I needed even though I was frank enough to say that I could not tell whether an order would be placed until all the figures were in and I had a chance to work them out. I have always asked them not to spend a lot of money but to give me what information was available. They have also given me

advance information on new tools that was invaluable to me when the management had me in a corner and I had to answer an embarrassing question on costs in a hurry.

Perhaps a word about the nature of our product will not be out of place here. Ninety-five per cent of it is drop forged and subsequently machined. As a result the machine shop is constantly hounding the forge room for better forgings so that the amount of machining can be reduced. The machine shop would like to set a 0.010-in. limit on forgings but it has not been able to prove that such refinement of accuracy in drop forgings would be economical. As a matter of fact we are getting better than a commercial drop forging. The forgers are working to a $\frac{1}{32}$-in. limit although few pieces are outside a $\frac{1}{64}$-in. limit. When the outer limit is reached a terrible howl goes up from the machine shop.

The product at the South Plainfield plant consists of seven sizes of automobile universal joints for a large number of customers, makers both of trucks and pleasure cars, also a number of different sizes of clutches. At the Pottstown plant, which is a real production plant, we make three sizes of joints for a very limited number of customers. Many of our problems would be greatly simplified if the car manufacturers, and particularly the truck builders, would only get together and standardize.

For the few products of the Pottstown plant it has been possible to work up complete cost figures on every operation. These figures are on file and have been analyzed so that we know where the bottle necks are and which machines should be replaced whenever the management authorizes capital investment.

Our tendency to work toward one-operation machines is in line, I think, with the tendency in automobile and parts plants in general. Some of these machines are distinctly special machines but the majority are standard machines equipped or converted for single-operation work.

### An Example of Satisfactory Saving

We recently had a good example of the saving possible when buying equipment for this sort of work. Owing to a change in method we had to replace a fair-sized battery of lathes. Instead of ordering standard machines as equipped by the manufacturer we called in the lathe salesman and figured out what could be saved by eliminating the parts that were of no use to us. By the time we had cut out the leadscrew, the steadyrests, the face plates and a few other parts we had got the price down so that we saved some $400 on each machine, a reduction that represented a considerable saving because of the number of units purchased.

From the nature of our work we can also make considerable savings from the use of the very best drills, reamers and milling cutters for the particular job in hand. That may sound obvious but let me explain. One of the big operations on a universal joint fork is slot milling with two half side mills in a Briggs-type miller. We were getting cutters from several of the leading makers and results were not always uniform. Some of the men in the shop swore by one make of cutter, others were equally loyal in their support of the merits of some other make. We finally settled the matter by getting from each of four cutter makers a detailed blueprint of the cutter he recommended for our job. We took these blueprints and evolved from them a composite cutter that had the good points of each of the others and one or two ideas of our own besides. Then we ordered a set of the composite cutters from each of the makers and kept careful records of their output per grind and total life. The records were made by a student engineer who had no interest in any cutter, one way or the other.

As a result of our tests we settled on three cutter makers rating them as one, two and three. Our first choice of cutters is the composite cutter as made by maker No. 1, but we can get along with his own cutter in emergency or with the composite cutters or individual cutters of the other two makers if No. 1 cannot supply us. It really boils down to a question of material and heat treatment.

### Getting Facts on Drill Performance

A somewhat similar condition existed with the drills we were using. I was and am still partial to one of the best makers because of the treatment they have accorded us over a period of years. Until some one shows us a decidedly better drill it will be hard to break in. Several of the foremen, however, were so strong for another make of drill that they even went so far as to say they could save money for the company if they were allowed to buy their own drills. Finally I put it up to them to have a disinterested test of both makes of drills conducted by a student engineer. The results were surprising. One manufacturer was better on the medium sizes of drills, the other was better on reamers and for some sizes of drills there was little to choose.

In almost any shop it will pay to make the tests necessary to give the actual life of cutting tools on each job. The best tool may not always be the cheapest as its superiority may be so slight that the lower cost of another tool may more than offset the slightly longer life of the first one. The decision on which tool to buy should only be made after careful study, care being taken to see that no one of the factors involved is left out of consideration.

Another item that will loom large on the right side of the ledger is the scientific application of belting. It is just as important to get the power into a machine as it is to have the right machine for the job. We have made an extensive study of belting here and the savings have been appreciable.

One other point in the application of power deserves study from the dollars-and-cents angle and that is the power factor. In a plant equipped with many small motors it often happens that quite a few of them are seldom operating at full load. The result is a low power factor and if the power is purchased this inefficiency usually means a penalty rate. In such a case it may prove wise to substitute group drives through belting from a larger motor. Here again all factors must be considered, particularly the flexibility of machine arrangement attainable with individual motors. The nature of the product and the likelihood of changes will probably determine which system is most advantageous.

[The preceding article is the seventh under the title, "Getting the Most Out of Your Machine Tool Dollar." The first article, by J. A. Smith, General Superintendent of the General Electric Co., Schenectady, N. Y., was published on page 409, Vol. 62. The second by C. A. Shaffer, General Supervisor of Machinery and Tools of the Illinois Central Railroad, was published on page 521, Vol. 62. The third, by Robert F. Runge, Vice-president of SKF Industries, Inc., was published on page 719, Vol. 62. The fourth, by L. C. Morrow, Managing Editor, *American Machinist*, outlining the policies of the International Harvester Co., was published on page 793, Vol. 62. The fifth, by G. T. Christopher, Factory Manager, the Dayton Engineering Laboratories Co., was published on page 907, Vol. 62. The sixth by D. C. Wright, of the H. W. Caldwell & Son Co. plant of the Link-Belt Co., was published on page 1, Vol. 63. Other articles on the same subject will be published in forthcoming issues.]

# Standardized Sub-Press Compound Dies

**By W. E. Irish**
Associate Editor, *American Machinist*

## Sub-press tools for small-part stampings—Description of their operation—Returning the blanks to the stock strip—Standardization of design, construction and application

IN THE Hawthorne Works of the Western Electric Co., at Chicago, quantity production of small interchangeable stampings necessitates standardized tools and equipment.

This article presents information given in keeping with the company's open-minded policy on standardization methods and design as applied to sub-press compound dies for stamping small parts.

The subject divides itself into two main subjects, which are construction of the tools and standardization of this construction for application to uses in production. Five tool sizes have been adopted by the company as most suitable for the range of the majority of the work, the three smaller ones, known as the Nos. 2, 3 and 4, being of the cylindrical type and the two larger ones, known as the Nos. 5 and 6, of the pin or pillar type. While this by no means represents the limit to which standardization has been carried on tool work, they are typical and further discussion would be a repetition.

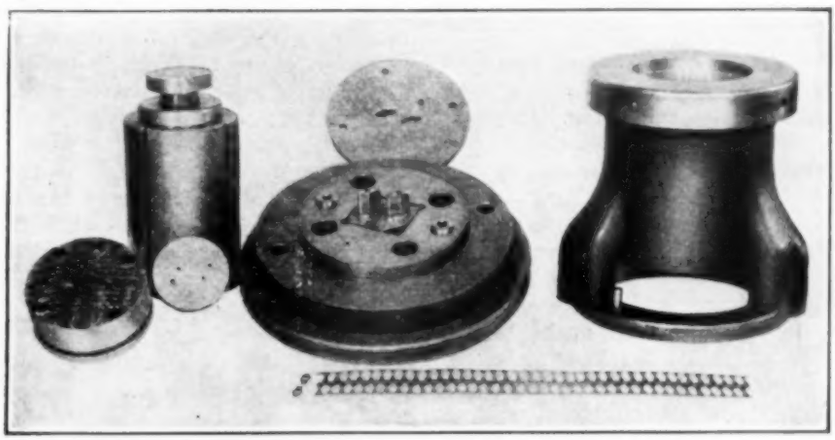


*Fig. 1—One of the cylindrical-type tools partly dismantled*

One of the smaller sizes of a completed tool of the cylindrical type, partly dismantled, is illustrated in Fig. 1. It will be noted that the guiding member between the ram and base is a solid casting within which the plunger operates.

In Fig. 2 is shown one of the larger sizes of the pin-type tool and in Fig. 3, the same tool partly dismantled. Here it may be seen that the plunger carries lugs which have been bored and bushed to guide on pins set into the base, thus eliminating the frame casting of the smaller sub-press and making possible good proportioning between the diameter of the plunger or pin and the length of its corresponding guide. In this particular case, the standard round die has been replaced by a rectangular one on account of its better adaption to the long narrow parts, two of which, as will be noted, being produced at each stroke of the press.

A cross-sectional view of one of the smaller cylindrical type or Nos. 2, 3 and 4 sub-press compound dies is given in Fig. 4, with the various parts lettered for reference and identification purposes and dimensioned so that an idea of size ranges may be gained. While the pin-type sub-press differs from the larger design in construction and dimensions, the functions of the various parts are similar so that the diagram will serve satisfactorily for both.

The diagram is constructed to show the various details of construction and the relative positions of the parts to each other and to the material being worked on in both extremes of the press stroke. Thus, the press is shown at the top of its stroke to the right of the vertical center line and at the bottom to the left of this line. This will enable the reader to check the action, as well as the general assembly and to better visualize the functions and movements of each part, such as movement of stripper and shedder, compression of the different springs and blank displacement.

The identifying letters are placed on the right-hand section and dimension numbers are shown to the left.

A table to the right of the diagram lists these letters and gives the name of the part and the material of which it is made, together with information that has to do with standardization. To the left is a table giving the dimensions of the various parts.

Referring to the diagram, the babbitt bushed frame *G* that guides the plunger *D* is bolted and doweled to the base *H* by means of fillister-head screws *J* and dowels *Z*. The dowels, in actual practice, are placed approximately 50 deg. from the position shown, which is clearly illustrated in the frame in Fig. 1. Keyways in the plunger, which show plainly in Fig. 1, engage corresponding keys cast in the babbitt bushing *F* to keep the plunger from turning. One of these keys can be seen in Fig. 1 on the bushing, inside of the frame assembly. The spacing of the keyways in uneven degrees is worked out so the plunger cannot be assembled in any position but the correct one.

Keys, on the outside surface of the bushing, fit into corresponding recesses in the frame, similarly laid out in uneven degrees, so there is no danger of its shifting or of being replaced incorrectly after having been removed for any reason. The babbitt bushing is held securely in position in the frame by means of the frame cap *E*. This cap can be screwed down to eliminate any looseness between the plunger and the frame on

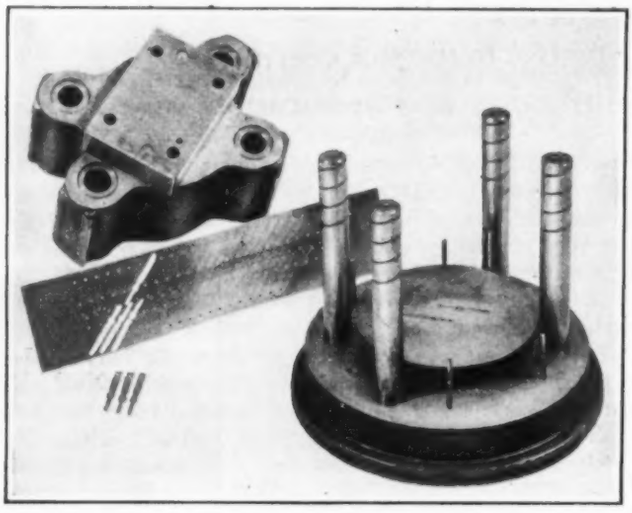


*Fig. 2—The larger pin-type and a sample of the work*

assembly and serves, further, to compensate for wear in the same manner. Oil grooves cut in the babbitt insure adequate lubrication for the length of the plunger.

The die parts *K*, *L*, *M*, *O*, *P* and *Q* are secured to the plunger *D* by means of fillister-head screws *N*. The taper shoulders on the punch plate *M* serve to center the parts with the plunger and with each other. A dowel through the die blank *Q*, the punch plate *M* and the plunger *D*, sets and holds the location of the parts in line with the plunger. The dowel is not shown in the diagram as it is on the same dimension circle as *N*, the holding screws.

The punch parts are set into the base *H* and are doweled in position. Fillister-head screws *X*, hold them rigid.

The screws *V* and the springs *U* hold and control the motion of the stripper plate *R*. In the case of frail or delicate punches, this stripper plate is further guided by means of stripper-guide pins secured in the plate and working in guide bushings which are fitted in the base casting thus tending to minimize strains on the punches. These are not shown in the diagram, as the punch illustrated is of sturdy design but, in Figs. 1 and 3, they do appear.

Guide pins *Y*, more clearly shown in Fig. 2, are set in the base to locate the strip stock between the cutting members of the tool. When a new strip is to be started, however, it is necessary to have a registering point close enough to the dies so the first blank will come economically close to the end of the stock. The starting pin *T* is included for this purpose. It is made with a sliding fit in the stripper plate and in the base. A spring *W* holds it projecting through the stripper plate to its limiting shoulder. When the plunger is up, the pin projects. In descending, the plunger pushes it against the spring, down through the plate and base, so it does not interfere with the operation of the press and to avoid cutting a clearance hole in the die as would be the case were the pin made solid.

In service, the plunger descends on the work. The perforating punch *O* blanks out the hole, the slug going down through the punch *S*. At the same time, the die *Q* depresses the starting pin *T* and blanks the part on the punch *S*, depressing the scrap and stripper plate against the action of the stripper springs. The blanked and perforated part is forced into the die, depressing the shedder *P* against the action of the shedder spring *C* which transmits pressure to the shedder through the shedder plunger *B*, and *L*, the shedder push pins.

The stroke of the press is set just deep enough so the material will part and, as a matter of fact, the punch should not enter the die as the break occurs before the edges of the punch and die meet. In the diagram, however, the cutting edges of the punch and die are shown in line as a matter of convenience since it is impossible to determine at just what point the material does part; controlling factors, of course, being the degree of hardness and the kind of material being punched.

The depth of the recess in the die, for the flange of the shedder *P*, is controlled by the thickness of the material, allowance usually being made for two blanks plus a small amount for lost motion. The underlying reason for the additional clearance over and above the thickness of one blank being one of safety.

The parts are so dimensioned and set that the assemblies, in both base and plunger, will present flat surfaces when the plunger is off the work. When the plunger rises, therefore, the stripper plate *R* returns the scrap to its original position and the shedder *P* holds the blank against the punch *S*, while the perforating punch *O* and the die *Q* are returning upward.

Thus, the part is returned to its original position in

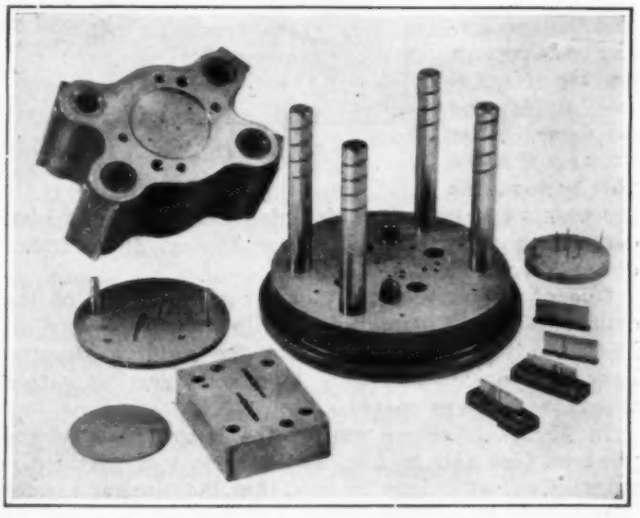


*Fig. 3—The component parts of the pin-type die*

the stock or rather the scrap is brought up to surround it and will remain there, as shown in Fig. 4, until it is knocked out by shaking the stock strip. This makes a simpler and more rapid method of clearing the press of the blanked parts than were it necessary to remove each one soparately.

To accomplish the desired action, it is essential to have sufficient strength and initial compression in the shedder spring *C* to hold the blank on the punch against

the drag of the perforating punch and the die, and to not allow any upward movement and corresponding snap-back of the shedder after the plunger is on its way to the top of the stroke. If this pick-up and snap-back were allowed, it would tend to knock the other blanks out of the scrap as well as to allow the scrap to shift out of position as the strippers cleared it of the punch.

In the plunger assembly, it will be noted that the hardened support plate *K*, acts as a backup for the punches *O*, while the hardened punch plate *M*, serves as a backup and locator for the die *Q*, and as the locator for the perforating punch *O*. The shedder push pins *L* are set for the proper action of the shedder, their number and location being determined from the die layout which is described under the heading of standardization.

An assembly of one of the punch and die sets that shows the trend of construction of the tools used beyond the range of the Nos. 2 to 5 sub-presses, or for hand-fed tools, or tools for a smaller number of parts, is shown in Fig. 6. This tool, however, is not pertinent to the discussion and is shown and mentioned only from the point of general interest.

There are two main guide pins that register the punch and die in place of the four used in the pin-type sub-press construction. It will be noted that the tool has been provided with sheet-metal guards to reduce the possibility of injury to the operator and that an automatic stop has been provided for registering the distance between blanks, the edge of the hole in the part being used as a registering point. The two pins shown projecting above the spring stripper are secured to the stripper and provided with a slot through which the stock passes and which prevents the stock from being lifted off of the face of the stripper by the upward spring tension of the locating end of the stop.

## Standardization of Construction and Application

The first step toward standardization was to determine on the sizes most suitable for the range of work to be covered. After this was obtained it became necessary to prepare the detailed information pertaining to all the parts of the sub-presses and dies so that it would be readily available and to insure that full advantage would be taken of the possible resultant economies in tool designing as well as in tool building. Therefore, in conformance with the regular practice, a complete set of drawings were made for the "book of mechanical-design standards," which is a work of reference prepared primarily for use of the tool-design organization.

The sheets of this reference work have also been standardized as to form and size, being 9½x12 in. in size, printed on cloth and perforated for convenient binding. These mechanical-design standards show, in detail, the dimensions and construction of the tools, the condition in which the various parts are carried in stock, that is whether singly or in partial assembly, stock numbers under which they are known in the store room, and other essential information. Those parts such as punches, shedders, or others that involve dimensions depending on the parts they are to make were also detailed as to general shape and form with actual dimensions, as far as possible, and noted as to variations that could not be previously determined.

Working drawings were prepared for the use of the

| No. | Main Dimensions 2 | 3 | 4 |
|---|---|---|---|
| 1 | 9 3/8" | 10 1/4" | 10 1/2" |
| 2 | 5" | 5 1/8 | 5 1/8 |
| 3 | 15/16" | 1" | 1 1/8" |
| 4 | 1.324" | 1.324" | 1.324" |
| 5 | 1/2" | 1/2" | 1/2" |
| 6 | To suit stock | | |
| 7 | 5/8" | 1" | 1" |
| 8 | 1 3/8" | 2" | 2" |
| 9 | 1 1/2" | 1 5/8" | 1 5/8" |
| 10 | 1/32" | 1/4" | 1/4" |
| 11 | 15/16" | 1 1/8" | 1 1/4" |
| 12 | 3/4" | 1 1/8" | 1 1/4" |
| 13 | 5/8" | 5/8" | 11/16" |
| 14 | 13/16" | 1" | 1 1/8" |
| 15 | 1/8" | 1/8" | 1/8" |
| 16 | To suit stock | | |
| 17 | 1 3/8" | 1 7/8" | 1 1/2" |
| 18 | 1/2" | 1/2" | 1/2" |
| 19 | 1/8" | 1/8" | 1/8" |
| 20 | To suit stock | | |
| 21 | 1/4" | 5/16" | 5/16" |
| 22 | 3 1/2" | 3 1/2" | 3 1/2" |
| 23 | 3 3/4" | 3 3/4" | 3 3/4" |
| 24 | 5/8" | 3/4" | 3/4" |
| 25 | 9/16" | 1 1/8" | 1 1/8" |
| 26 | 1/16" | 1/16" | 1/16" |
| 27 | 0.460" | 0.460" | 0.460" |
| 28 | 0.427" | 0.427" | 0.427" |
| 29 | 1 3/8" | 2 3/8" | 2 3/8" |
| 30 | 1.615" | 1.615" | 1.615" |
| 31 | 2.200" | 3.250" | 4.200" |
| 32 | 3 1/2" | 4 3/8" | 6" |
| 33 | 1 1/64" | 1 39/64" | 1 59/64" |
| 34 | 3 1/16" | 4 13/32" | 5 1/4" |
| 35 | 2 1/2" | 4 1/4" | 5" |
| 36 | 5" | 7" | 8" |
| 37 | 6" | 8" | 9" |
| 38 | 3/8" | 3/4" | 3/8" |
| 39 | 2 1/8" | 3 3/32" | 4 1/16" |
| 40 | 13/16" | 3/4" | 1/8" |

| Pt. | Name | Mat. | Remarks |
|---|---|---|---|
| A | Cap adapter | T.S. | |
| B | Shedder plunger | T.S. | |
| C | Shedder spring | S.S. | Standard |
| D | Plunger | C.I. | carried in stock assembled |
| E | Frame cap | C.I. | |
| F | Frame bushing | BAB | |
| G | Frame | C.I. | |
| H | Base | C.I. | Std. Blank |
| J | Frame assembly Scr. | M.S. | Standard |
| K | Support plate | T.S. | Std. Blank |
| L | Shedder push pin | T.S. | To suit |
| M | Punch plate | T.S. | Std. Blank |
| N | Plunger assembly Scr. | M.S. | Standard |
| O | Perforating punch | T.S. | To suit part |
| P | Shedder | T.S. | To suit part |
| Q | Die | T.S. | Std. Blank |
| R | Stripper plate | T.S. | Std. Blank |
| S | Punch | T.S. | To suit part |
| T | Starting pin | T.S. | Standard |
| U | Stripper spring | S.S. | " |
| V | Stripper screw | M.S. | " |
| W | Starting pin spring | S.S. | " |
| X | Punch assembly Scr | M.S. | " |
| Y | Stock guide pin | D.R. | " |
| Z | Dowel | D.R. | " |

Part list and main dimensions subpress assembly diagram for press Nos. 2-3-4

*Fig. 4—Standard identification cross-section*

tool-making organization, of each part to be carried in stock. Each part, whether a detail or a partial assembly, was assigned a reference identification number known as a "stock number" which, as previously mentioned, also appears on the reference sheets used by the designers.

Parts are made for stock, by the tool-making organization, from these drawings for all sizes and may be requisitioned from stock by merely specifying the stock number.

It can be realized that it would not be good practice to have the designers and toolmakers work from the same data sheets as all parts cannot be made up complete and carried in stock in a fully finished condition. Allowances for fitting, grinding, lapping and other operations, prior to final assembly are necessary, in many instances, on the working drawings for the toolmakers; whereas the data for the designers must show final dimensions of completed parts.

Partial or sub-assemblies are resorted to wherever feasible as they are better adapted to carry in stock than the individual pieces. They can be issued as units in place of unfitted parts and help materially to reduce the time required for completing the tool after the order is received. As an example, in the case of the Nos. 2, 3 and 4 sub-press compound dies, the tool divides itself into three main groups:

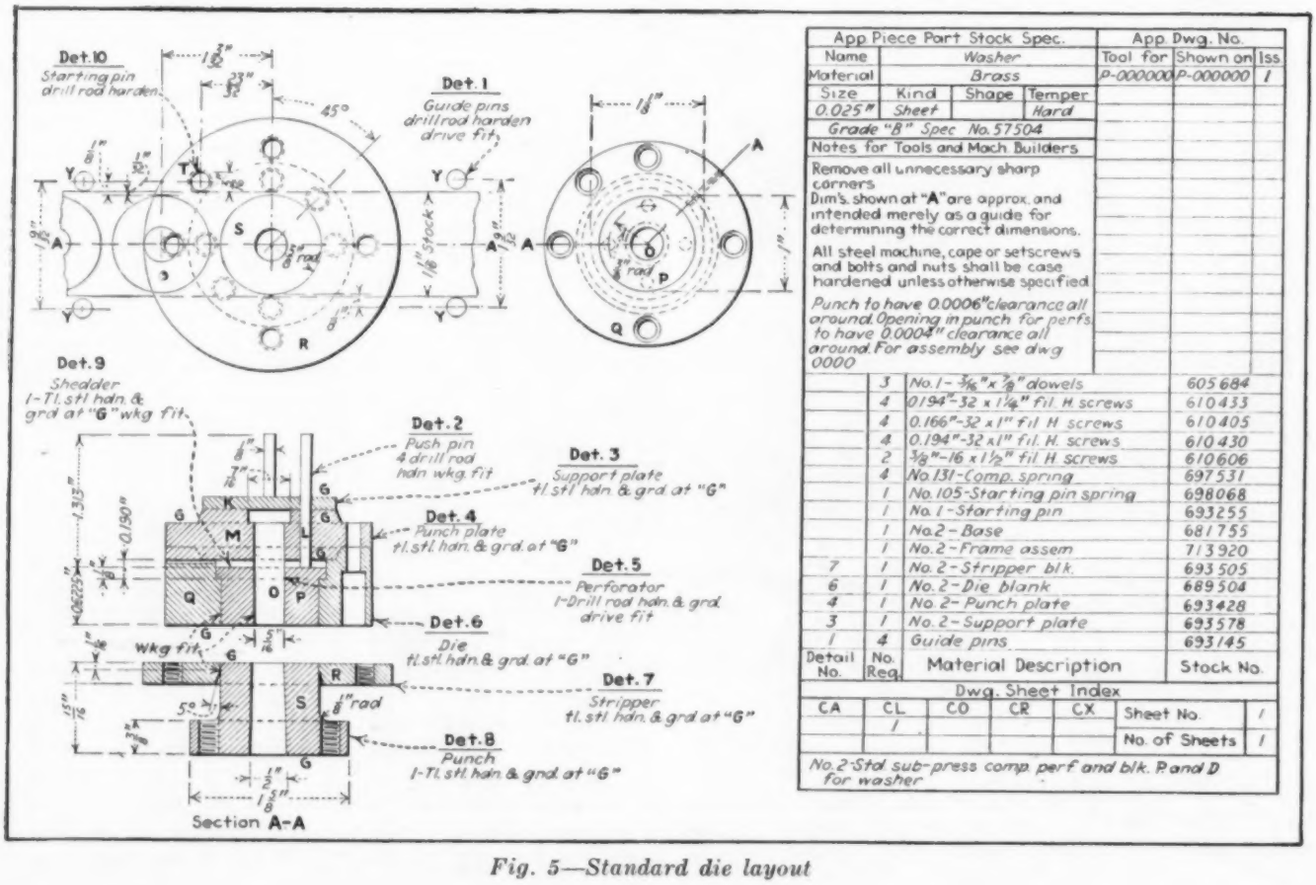
1. The plunger and frame assembly.
2. The base.
3. The punch and die parts.

Of these, the first two are carried in a completed state with the exception of fitting and assembling to each other and the final adapting of the punch and die parts thereto. The punch and die parts, however, are stocked as individual parts, finished to as great an extent as possible with the exception of the shedder and punch which vary to suit each individual case.

Assuming now, that it is required to build a sub-press compound punch and die for a simple round washer, which has been adopted for this article in order to simplify the description, the tool design organization prepares a drawing on one of the standard forms provided and known as a die layout. Three views, as in Fig. 5, are generally shown, a vertical cross-section, a plan of the stripper and punch immediately above this with the necessary stock guide pins and, to the right, an inverted plan of the die and shedder. For the reader's convenience in identifying the various parts and associating them with the assembly in Fig. 4, they have been lettered the same as on the assembly.

This drawing, as will be noted, shows the variable parts of the tool with such dimensions as are needed for making up the blanking and perforating punches, shedder and push pins and for making the stock parts adaptable to the job at hand. The strip stock is shown in position and the location of the gage pins, starting pins, stripper-screw holes and similar points are determined and noted. All dimensions of the stock parts are obtained by the draftsmen from the mechanical-design standard sheets, previously mentioned.

At the right-hand side of the drawing form is provided a four-column table in which all the parts carried in stock that are required to make up the complete sub-press compound die are listed. On the die layout reference is made to an assembly drawing. This drawing is very similar to Fig. 4, in that it is an assembly drawing of the sub-press showing the workman how the frame and base are assembled and how the parts shown on the die layout, Fig. 5, are assembled to the plunger and base. Thus, with the layout, Fig. 5, and a copy


Det. 10
Starting pin drill rod harden
Det. 1
Guide pins drill rod harden drive fit
Det. 9
Shedder 1-Tl. stl hdn. & grd at "G" wkg fit
Det. 2
Push pin 4 drill rod hdn wkg. fit
Det. 3
Support plate tl. stl hdn. & grd. at "G"
Det. 4
Punch plate tl. stl. hdn. & grd. at "G"
Det. 5
Perforator 1-Drill rod hdn. & grd. drive fit
Det. 6
Die tl. stl. hdn. & grd. at "G"
Det. 7
Stripper tl. stl. hdn. & grd. at "G"
Det. 8
Punch 1-Tl. stl. hdn. & grd. at "G"
Section A-A

| App. Piece Part Stock Spec. | | | | App. Dwg. No. | | |
|---|---|---|---|---|---|---|
| Name | Washer | | | Tool for | Shown on | Iss |
| Material | Brass | | | P-000000 | P-000000 | 1 |
| Size | Kind | Shape | Temper | | | |
| 0.025" | Sheet | | Hard | | | |
| Grade "B" Spec. No. 57504 | | | | | | |
| Notes for Tools and Mach. Builders | | | | | | |
| Remove all unnecessary sharp corners | | | | | | |
| Dim's. shown at "A" are approx. and intended merely as a guide for determining the correct dimensions. | | | | | | |
| All steel machine, cape or setscrews and bolts and nuts shall be case hardened unless otherwise specified | | | | | | |
| Punch to have 0.0006" clearance all around. Opening in punch for perfs to have 0.0004" clearance all around. For assembly see dwg 0000 | | | | | | |

| Detail No. | No. Req. | Material Description | Stock No. |
|---|---|---|---|
| | 3 | No. 1 - 3/16" x 3/8" dowels | 605684 |
| | 4 | 0194"-32 x 1 1/4" fil. H. screws | 610433 |
| | 4 | 0.166"-32 x 1" fil. H. screws | 610405 |
| | 4 | 0.194"-32 x 1" fil. H. screws | 610430 |
| | 2 | 3/8"-16 x 1 1/2" fil. H. screws | 610606 |
| | 4 | No. 131-Comp. spring | 697531 |
| | 1 | No. 105-Starting pin spring | 698068 |
| | 1 | No. 1-Starting pin | 693255 |
| | 1 | No. 2-Base | 681755 |
| | 1 | No. 2-Frame assem | 713920 |
| 7 | 1 | No. 2-Stripper blk. | 693505 |
| 6 | 1 | No. 2-Die blank | 689504 |
| 4 | 1 | No. 2-Punch plate | 693428 |
| 3 | 1 | No. 2-Support plate | 693578 |
| 1 | 4 | Guide pins | 693145 |

Dwg. Sheet Index

| CA | CL | CO | CR | CX | | |
|---|---|---|---|---|---|---|
| | 1 | | | | Sheet No. | 1 |
| | | | | | No. of Sheets | 1 |

No. 2 Std. sub-press comp. perf and blk. P and D for washer

*Fig. 5—Standard die layout*

of the standard-assembly drawing, the toolmaker has complete tool-building information and can requisition all of the material and partly completed stock parts.

Two distinct assembly drawings with complete dimensions, in tabulated form, have been prepared, one for the Nos. 2, 3 and 4, or cylindrical-plunger type, and one for the Nos. 5 and 6, or pin-type sub-press.

### Summary

To summarize from the standpoint of construction, the following points should be mentioned as definite steps toward maximum production combined with continued tool accuracy and economical construction:

1. The feature of returning the blank to the scrap in order to handle it readily, and the combination of inverted part-punch and die, stripper and shedder for this purpose.

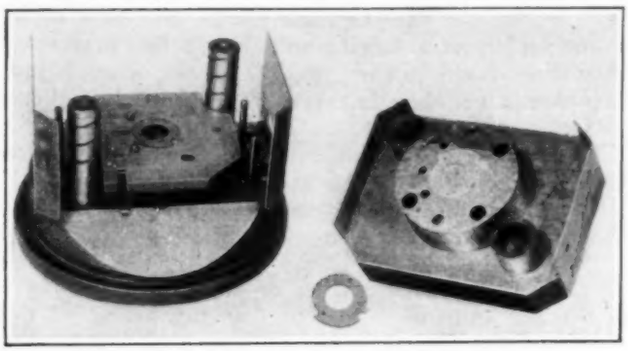


*Fig. 6—Another of the pin-type designs*

2. The combination of perforating punch in the plunger so located as to clear the punchings down through the bottom of the tool.

3. The guiding of all moving work parts, particularly the perforating punches, which thus have very little unsupported length and can be successfully used on extremely small perforations.

4. The guiding and take-up possibilities in the babbitt plunger bushing not as readily possible in any other way.

5. The shoulder arrangement for centering the die parts on the plunger and the simple construction of the perforating-punch back-up plate.

6. The provision for rapid disassembly for sharpening or repair with the surety of returning all parts to exact alignment without the necessity of any careful check.

All of these points show the thoughtful design which has been put into the line of tools by the Western Electric Company's engineers.

From the standpoint of standardization:

1. The combination of details, sub-assemblies and size-range tables, all on standard-size sheets, makes the possibility of drifting away from set practice (a common tendency and a dangerous one) a negligible feature.

2. The combination of the table by which reference may be made to details, and with which stores can be requisitioned, serves to keep manufacturing costs to a minimum and to materially decrease the time between order and completion, as well as to reduce the chance of error in constructing the tool for the given piece of work to be manufactured.

Standardization is applicable in some form to every division of any business. It is a productive means of bettering conditions if it is properly introduced and constructively developed. Particular care, however, must be exercised at the start. Every angle of the problem must receive attention, and the ultimate aim must be clearly defined in order to obviate, as far as possible, the necessity for change at important points after the plan has been settled on and the design completed.

Many a firm has failed to realize the profit it might have made from systems of standardization due to failure to appreciate the value of these items, and of others, peculiar to its given business. Changes in systems and designs have been allowed as time went on without check of what might result, so that the original scheme of standardization is almost lost to view.

Some companies there are, in fact, which are bitterly opposed to even mention of the word, due to their own unfortunate experiences.

On the other hand, there are firms to which standardization is an absolute necessity in order for them to progress at all. These firms have literally been forced to standardize. When they have made mistakes, they have had to correct them and go on again. They could not go back to haphazard methods from the very nature of the business, whose life was dependent on standardization. Some of them had to learn by hard experience.

Others, and the Western Electric Company is one, studied the problem with regard to fundamentals before going ahead, as this article bears evidence.

## Machine Control

By W. S. Davenport

In cutting threads in a lathe driven from a friction countershaft, machinists generally operate the shifter with the left hand, and nearly all such lathes are so arranged that the shifter is moved toward the headstock for the forward motion and toward the tailstock for the reverse. It is not unusual, however, to find a group of lathes in which the countershafts are so belted that some are started by moving the shifter to the left and others by moving it to the right.

It would be far better to have all machines arranged to be started by the same motion of the same hand, and with a little thought in arranging the countershafts, this can easily be provided for.

Many machines are now built in which the movement of several levers is required for the complete operation of all their parts. Unfortunately all builders have not designed such machines so the levers are to be moved in the same direction to start their respective movements. Abrasive wheels on grinding machines have been broken because of the confusing directions.

Some years ago, the writer designed a machine in which the feed was started by moving a lever to the left, and stopped by moving the same lever to the right. About the same time another builder designed a similar machine in which the lever for starting and stopping the feed was held by a latch when in either position. In operating the feed, it was necessary to trip the lever, causing the operator to use an unusual movement.

This is one of the points where uniformity in machine design would be advantageous to the users. This article is written in the hope that it may reach the eyes of many machine builders and designers, and that uniformity in the movement of control levers will be adopted.

# The Heat-Treatment of Large Castings

By A. O. Schaeffer
Assistant Engineer of Tests, Midvale Company

THE development of the manufacture of large forgings is progressing rapidly. With turbine units approaching the 100,000 kilowatt mark, with boilers developing around 3,000 lb. per sq.in. pressure, and the growth of the cracking of oil at high temperatures and pressures, the demand for large forgings formerly furnished by instruments of war is gradually returning to a peace-time basis.

The treatment of large forgings usually begins with a heat several hundred degrees above the critical range, to bring about the complete solution of the constituents and to eradicate the forging structure. The forgings may be cooled in the furnace or in the air, but if the cooling is accomplished outside the furnace, the piece should be well protected from drafts of air, moisture, or any other conditions which would induce non-uniformity. To refine the grain structure, a "stepped" anneal is resorted to. The initial heat is at a high temperature for the reasons given above. The second may be at a temperature slightly above the critical range, and this heat should be followed by one below the critical range. In some instances one or more additional heats above the critical range may be required to produce thorough grain refinement through the section and as much as two weeks needed for completion.

## Effect of Heat-Treatment

In the cooling of large forgings by any method, the surface cools at a more rapid rate than the interior. This tends to produce a comparatively fine grain structure at the surface which becomes gradually coarser toward the center of the mass. The effect of repeated treatments as shown by experience is to increase the depth of the zone of finer grain structure, and to cause a proportional improvement toward the center of the mass. What cannot be accomplished with one heat-treatment on large forgings is often accomplished by several.

This principle should be borne in mind in treating comparatively large forgings requiring quenching to produce the physical properties desired. The metal should be conditioned for the quenching treatment by an air-quench and draw. This method accomplishes a certain amount of grain refinement and makes the quench more effective. A second quench is frequently resorted to for the same reason.

It is sometimes difficult to prevent warpage or distortion in large and uneven masses of metal. Heating and cooling should be as uniform as possible. The forging should be well supported in the furnace to prevent this trouble. For this reason, gun forgings and long shafts are suspended vertically. On quenching, the entire piece should be dipped as rapidly as possible.

Many large forgings, both of carbon and alloy steels, are successfully given treatments including one or more quenching operations. Turbine disks of carbon, nickel and chromium-nickel alloy steels show superior physical properties by this method of treatment. Large, high-carbon alloy steel rolls are hardened to over 110 scleroscope hardness. Before giving large masses of metal a quench, it is best to bore the forging to relieve the weak center-line of the ingot, and thus to increase the effectiveness of the quench.

The utmost care is necessary in the testing of large forgings in order to be sure that the conditions of the metal at all parts subject to strain is indicated. The locations of the test bars should be chosen to represent working conditions as nearly as possible. In a large forging, no single test bar can represent the average condition of the metal. The center line of the ingot is the weakest part of the forging. The smaller sections of the forging will show better properties than the larger portions because they have received more mechanical work and are also more affected by the heat-treatment. For the same reason, test bars taken at the surface of a forging will show better properties than those taken further into the mass. Enough test bars should be taken to represent the various sections subject to strain in use.

Photomicrographs, etch tests, and sulphur prints are all useful in showing the grain refinement, effect of working, the presence of non-metallic inclusions, and the segregation of any elements.

To be sure of the solidity of the piece, and the absence of shrinkage cavities or other openings, there is nothing quite as satisfactory as the boring of the piece and the inspection of the bore. All large rotor field shafts, turbine spindle shafts and similar objects should be bored and the bore inspected for cracks and other injurious defects that may have been produced by forging and heat treatment. The bore should be smooth and carefully examined with a bore searcher. Bore searchers are of various forms, either a simple light and mirror, or a series of reflecting mirrors with a telescope for magnification. Periscopes are made in the form of sectional tubes, carrying their own lights and magnifying the surface about two and one-half diameters. Any small imperfection may be removed by enlarging the bore. If the bore is clean, we may be reasonably sure of the rest of the forging.

## Other Testing Methods

Various methods of testing the rest of the mass are in existence. The changes in resistance to the passage of magnetic flux due to the segregation or the presence of non-metallic inclusions, might be recorded on large forgings and adapted to their testing as it is now used on smaller masses. X-ray apparatus will no doubt be successfully applied to the testing of larger masses of metal, and should provide a useful method of investigation.

An English company manufactures a so-called "clink detector." This is attached to the forging during cooling and is somewhat similar in action to the seismograph, although not at all similar to it in construction and design. It records any shock received by the piece, which might be caused by a clink or the internal cracking of the piece due to the giving way of the metal to some unbalanced strain.

Small non-metallic inclusions are always found in steel to a certain extent. If they are too large and frequent, they may make it impossible to obtain the desired physical properties in the forging. Large slag inclusions do not necessarily indicate the poor condition of the metal unless they occur in clusters.

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Abstract of "The Manufacture and Heat-Treatment of Large Castings," a paper presented before the Spring Sectional Meeting of the American Society for Steel Treating, Schenectady, May 28-30, 1925.

# Automotive Production

## Building McCormick-Deering Tractors

**Special Correspondence**

How certain engine parts are machined — Balancing of heavy crankshafts is quickly and efficiently done — Engines assembled in horizontal position—Assembly of tractors

MACHINERY for farm work is generally thought of as being of crude construction, built of parts that have been machined to uncertain limits and assembled in a haphazard way. On the contrary, the grueling tasks to which a machine such as a tractor is put require that the machine be so constructed that it will stand hard punishment without failure. That they are so constructed is evidenced by the manner in which parts for the McCormick-Deering tractors are produced, as described in this article. A study of the illustrations will show that few machine tools are at floor level. Many of them have been raised or lowered so that their tables are on the same level as the top of the conveyor line.

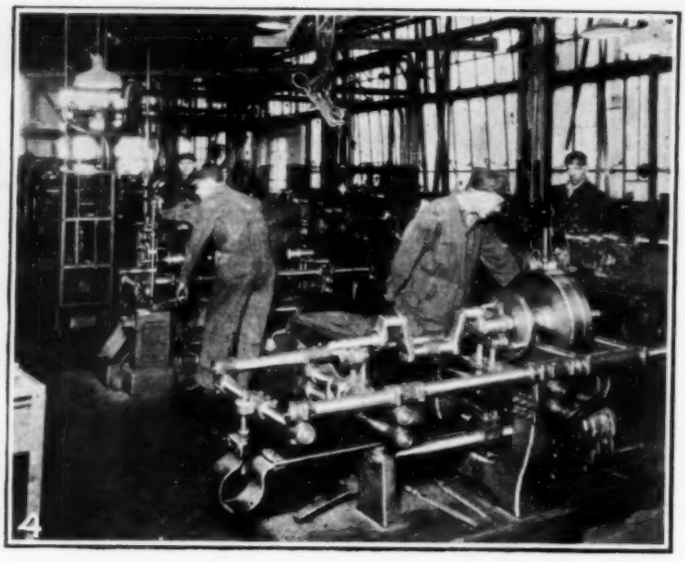
Both large and small ends of connecting rods are straddle-milled in the vertical machine shown in Fig. 1. The rods are locked into a revolving fixture that holds 16 rods, with the small ends toward the center.

*Fig. 1—Straddle-milling connecting-rods*

Each rod is placed between two grooved pieces that are locked in position by a wedge screwed between them at the periphery of the table, and are then locked in position by a clamp held by a stud and nut, as shown. The spindle carries two 8-in. side-milling cutters that mill the top and bottom sides of the small ends, respectively. Between the main spindle and the body of the machine are two short stub-spindles that carry 4-in. side-milling cutters, one of which faces the top and the other the bottom side of the large ends of the rods. The large cutters revolve at a speed of 30 r.p.m. and the small ones revolve at 66 r.p.m., while the table makes one revolution in 22 min. From $\frac{1}{32}$ in. to $\frac{1}{16}$ in. of stock is removed from each side of the rods and they are machined within 0.0025 in. of the drawing dimensions. Oil is used to facilitate the cut. The usual production is 360 finished rods in a working day of nine hours.

After the rods are milled, the large ends are bored to 2$\frac{1}{8}$ in. in a 4-spindle machine, and then passed to the 8-spindle machine shown in Fig. 2. This machine is built with a circular table that carries four fixtures, two of which are in operation while the third is in the loading position and the fourth is idle. The four spindles at the left of the operator carry two 8-blade reamers for the holes in the small ends of the rods and two 14-blade reamers for the holes in the large ends. This is the second boring operation and 0.030 in. is left to be removed in the final operation, which is done by the tools at the right of the operator, consisting of two 8-blade reamers for the small holes and two 10-blade reamers for the large ends.

Each piece is held in the fixture by a pin that fits into



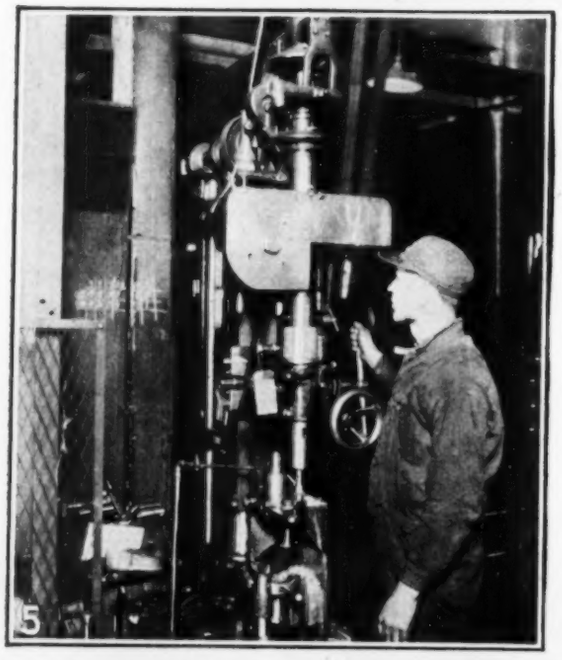


*Fig. 2—Reaming connecting-rods*

*Fig. 3—Crankshaft department*

*Fig. 4—Testing crankshafts for balance*

*Fig. 5—Balancing crankshafts by drilling*

# AUTOMOTIVE PRODUCTION

the cap-bolt hole and a screw that locks it into a V at the small end. The table feeds upward and the stop is set so that the instant the reamers are through, the table drops back far enough to clear them. The latch-lever, which can be seen at the front of the machine, is operated to release the table which is indexed to the next position, where the latch slips into place and the table is secured again. The jig bushings are of the screw type so that they will not slip out of the jigs when the tools are removed. Oil is used as a lubricant and the holes are machined within 0.002 in. of the drawing dimensions, plug gages being used to test with. Approximately 300 rods per day are machined on this operation.

The crankshaft department consists of two lines of machines along the whole length of one side of the shop, with a roller conveyor between the lines, as shown in Fig. 3. The shafts are put into trays that carry three each, and the trays are passed along from one operation to the next, the shafts being handled from the conveyor to the machines and back again by means of "scissors" grapples that are suspended from block and tackle. Thus the task of handling the heavy cranks is lightened as much as possible and the energy of the workmen is conserved for productive work. The finish diameter of the pins is 2.250 ± 0.0005 inches.

## Locating "Unbalance"

After the crankshafts have gone through the usual operations of turning, grinding and drilling, they are balanced on the machine shown in Fig. 4. This machine, although comparatively simple to operate, is very intricate and indicates the locations of both static and dynamic "unbalance." In order to test a shaft for balance, it is placed on the rollers, as shown in Fig. 4, and is connected to the headstock by a flexible driving connection. The frame to which the rollers are attached rests on a pair of knife-blade pivots where it is free to swing like a scale beam. Due to its weight, the frame has considerable inertia which is counteracted by the heavy loop spring at the lower left end of the machine. Therefore, with the frame and spindle at rest (not rotating), the frame will, when given an impulse, oscillate up and down with regular beats, the time of which is constant and independent of the amplitude of the swing.

The length of time for a complete oscillation under the conditions stated is called the "natural period" of the frame. When power is applied and the headstock, together with the shaft, is rotated, the shaft is rotated at a speed that is known to be greater than the natural period of the frame. Then the power is withdrawn and the shaft is allowed to rotate by momentum. The speed will gradually decrease until the speed of the shaft equals the natural period of the frame, which is said to be the "critical speed" of the shaft. The frame is connected to an indicator so that the amount of oscillation can be noted as the pointer moves back and forth across the face of the dial, and when the shaft reaches the critical speed, the reading is noted. By applying the reading to a calculating rule that is part of the equipment of the machine, the point of unbalance and the amount of stock to be removed are at once determined. The use of an adjustable counterbalance makes it possible to determine the exact degree of unbalance from center, so that the spot to be balanced can be determined. The shaft is turned end for end and both ends are tested and noted, then the shaft is sent to the next machine.

Each crankshaft is balanced by removing the amount of stock indicated and at the points indicated as a result of the balancing test, which is done by drilling 1-in. holes in the web of the shaft. The operator of the Gisholt balancing machine attaches to each shaft a tag that shows the number of ounce-inches of unbalance. His marking indicates whether the unbalance is on the gear end or the fly-wheel end and whether it is to the left or right of the center-line of the web of the shaft. For example, his marking for a shaft may be

G 9.8 — 10 R
F 6.6 — 7 L

The G and F designates gear or fly-wheel ends. The figures 9.8 and 6.6 indicate the settings to be made on

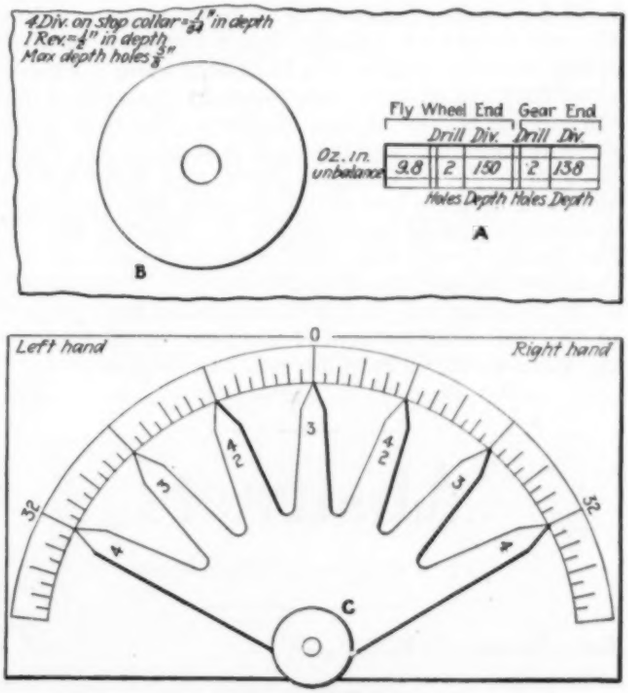



*Fig. 6—Indicator plate on drill press*

the table *A* to the left of the opening marked "drill" in the plate shown on the machine where the drilling is done, Fig. 5. The plate is reproduced in Fig. 6. The figures 10 and 7 indicate that the zero pointer of the dial *C* is to be set on the tenth division to the right, or the seventh division to the left of center.

The shaft is placed in the swivel jig, Fig. 5, and after its correct position for drilling has been obtained by movement of the lever *D*, the cam-actuated clamp *E* and another like it, but not shown, are operated to tighten the shaft, the spindle stop is set and the drilling of the web at one end of the shaft is carried on. The fixture is then swiveled to present the other end of the shaft. New settings are made after the shaft is reversed. The steps through which the operation advances are as follows: The operator turns the knob

# AUTOMOTIVE PRODUCTION

*B*, Figs. 5 and 6, to bring the numerals 9.8 opposite the arrow to the left of the first division shown in the table *A*. In a straight line opposite this arrow are then read the number of holes to be drilled and the depths of the holes. The seven-fingered dial *C* is rotated until the zero pointer is on the division to the right.

If two holes are to be drilled (and it will be remembered that this information is obtained from the table *A*), the locations of these two holes will be obtained by reference to the two fingers marked "2." The divisions at which they point will show the points to the left or to the right of zero at which the holes are to be drilled. In case three holes are called for, reference must be made to the pointers marked "3," and the same method is to be followed when four holes are to be drilled.

The locations indicated by these pointers have reference to a series of divisions marked on the face of the swiveling segment *D*. The crankshaft is held by this lever and, after the segment has been rotated until the number indicated is opposite the witness line, the cam clamps are brought into action and the shaft is held until the drilling has been completed. The divisions on the stop collar are shown in the table *A* and the method of setting is as follows: The drill is run down through the bushing until it touches the web of the shaft. The collar is run down until it touches the stop and is then backed off through the number of divisions indicated on the table *A*. Feeding the drill into the work until the collar brings up against the stop results in a depth of hole equal to $\frac{1}{64} \times \frac{1}{4} \times$ the number of divisions moved. It will be understood that the point of the drill must be ground the same at all times, or the value of the calculations will be nullified.

*(To be continued)*

# Abstracts

## *from other publications*

### Interchangeable Bearings

W. L. Carver, writing on the interchangeable bronze-back, babbitt-lined main bearings produced at the Olds Motor Works, details the manufacture of these bearings. The article contains a diagram of one of the bearings, and photographs to show the machining operations.

The babbitt process is as follows: Since it is desired that any bearing will fit any engine without the need for fitting or scraping, unusual limits of dimensional accuracy are maintained in the bearing department as well as in the manufacture of the crankcase and crankshaft.

In a general way, the production of these bearings involves the machining of oversize bronze shells which are then lined with babbitt. Following this operation, the bearing surfaces are machined, the split surfaces brought to the correct dimensions and the oil grooves and dowel holes added.

The shell is tinned all over, being, during the process, brought to a temperature about equal to that of the bath which is maintained at 625 deg. F. The shell is next transferred to a specially equipped speed lathe for the babbitting operation. The babbitt used has a high tin base. The composition is 85 per cent tin, 7.5 per cent copper and 7.5 per cent antimony. It is heated to 825 deg. F. in a gas-fired furnace, regulated by pyrometers. Using an ordinary ladle, the operator pours the necessary amount of molten babbitt into the opening in the tailstock spindle while the shell is stationary.

After a rather brief interval that is allowed for leveling and for the flotation of dross and dirt, the spindle is rotated at 900 r.p.m. and an air blast is turned on both the outside and inside of the shell. At this rate of rotation, a pressure of about 52 lb. per sq.in. compresses the molten babbitt to the point of solidification, producing a dense structure.—*Automotive Industries*, June 5, p. 978.

### New Electrical Instruments for Automotive Research

J. H. Hunt and G. F. Embshoff contributing this paper to the Cleveland Section of the Society of Automotive Engineers dealt with the great advances that have been made in research work by the use of proper electrical instruments. Using a detector on the circuit various reactions can be charted so they can be studied at leisure.

The paper is of great value because it describes the elements that have been found best suited for the desired purposes and shows how the detecting, measuring and recording elements are combined into complete, practical working instruments and how they are calibrated and used and also shows how the characteristics of diagrams are made with them.

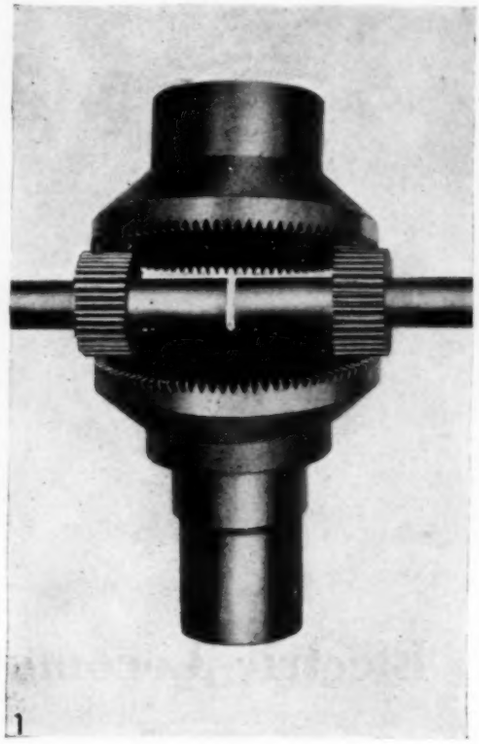
The article is well illustrated and there is an interesting bibliography at the end dealing with the oscillograph and also with sound transmission and recording. —*S. A. E. Journal*, April, p. 444.

### Silumin

Silumin, an alloy of aluminum silicon, is a casting metal having the following remarkable properties:

It has a strength of from 25,000 to 33,000 lb. per sq.in. with an elongation of 10 per cent. It shrinks very little in casting. The combination of high ductility with small shrinkage makes possible the production of very intricate castings. The temperature expansion of silumin is close enough to that of the heavier metals to allow the casting of parts of these metals with silumin.

The thermal conductivity is quite high. Chilled castings can be readily produced. Silumin has a specific gravity 10 per cent less than aluminum and on account of its greater strength it is possible to make silumin parts 30 per cent lighter than the same parts of aluminum. Silumin has a very close grain and takes polish very well. It is highly workable. All cutting can be carried out five times faster than with aluminum. Milling speeds of 32 ft. per sec. are possible.—*Automobile, Motarrad und Flugverkehr*, May 15, p. 240.



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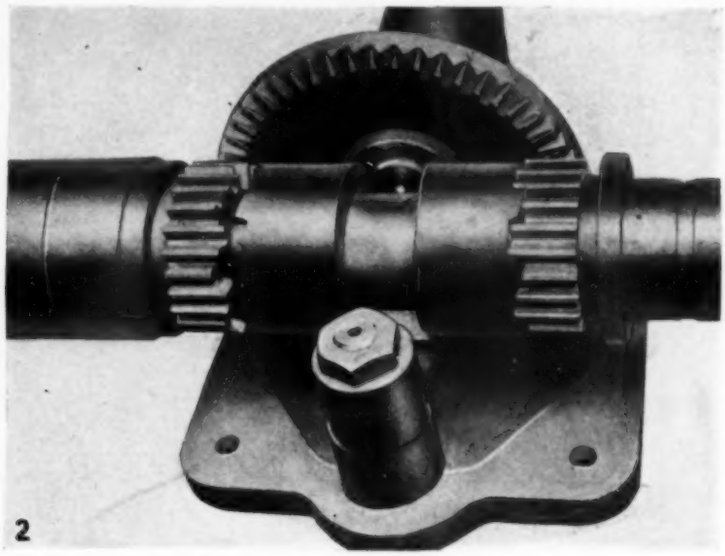


2

# Four Universal Gear Applications

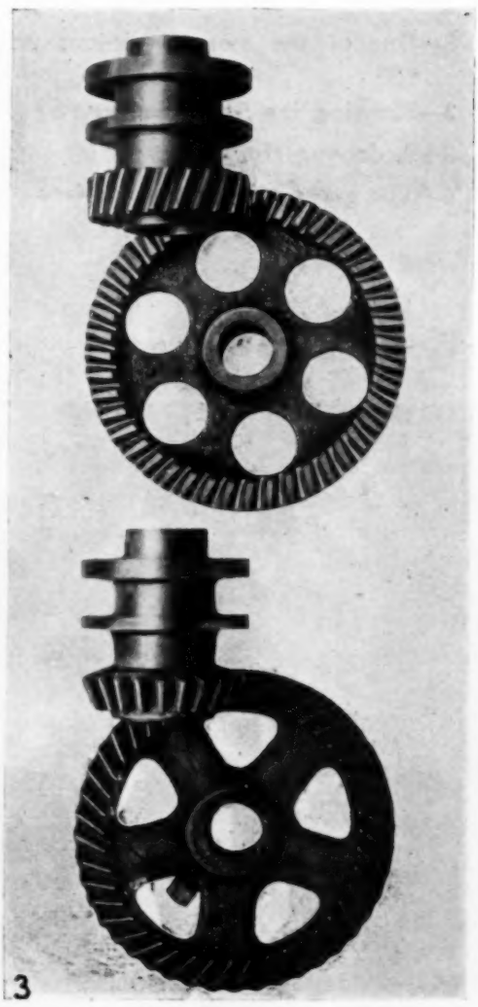
1—Two face or crown gears with pinions between. All cut with same cutter. Opposing gears turns in reverse directions. Face gears need not be in line, as can be seen

2—Crown gear used in reversing mechanism. Clutch teeth in ends of pinions

3—Face gears for textile machinery—one cast, one cut

4—Shows how face gears are applied to a spinning frame. Cut gears run very smoothly

Photographs by courtesy of the Fellows Gear Shaper Co.



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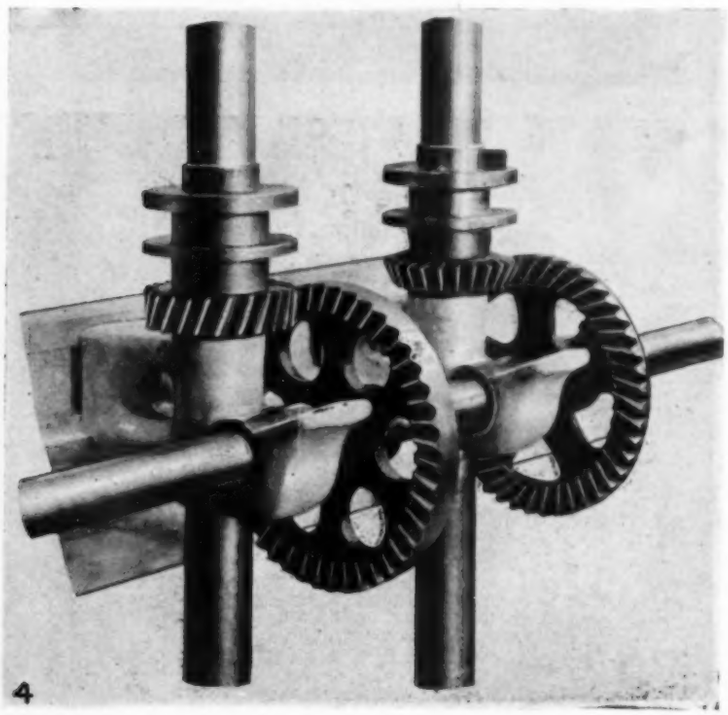

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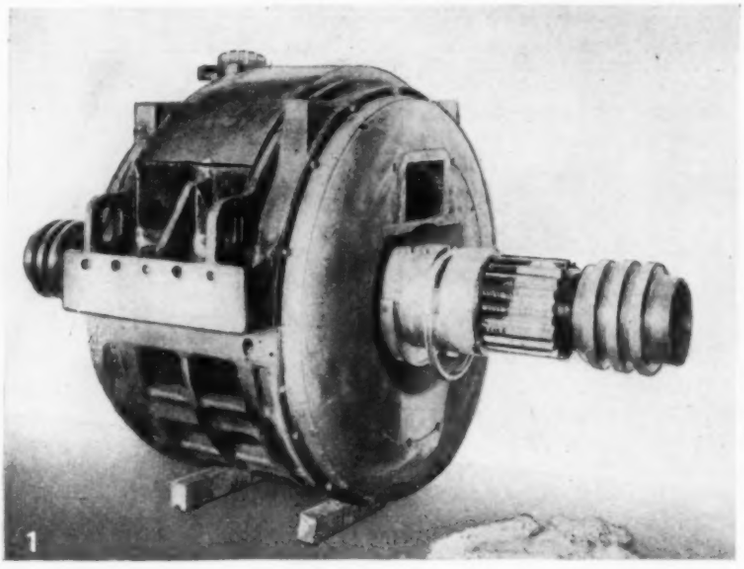

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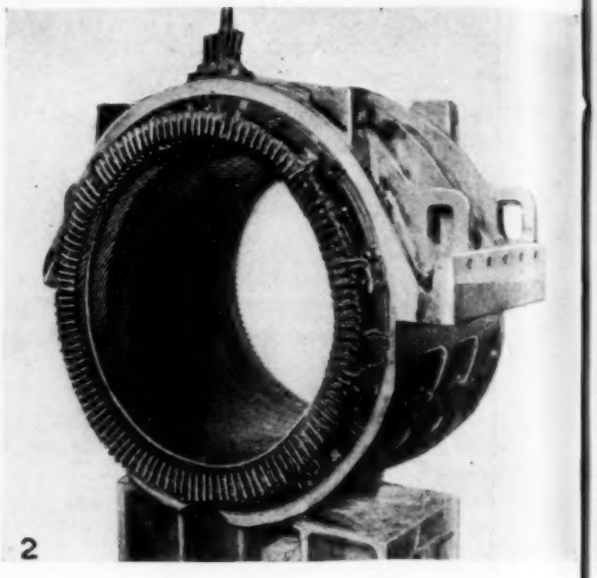

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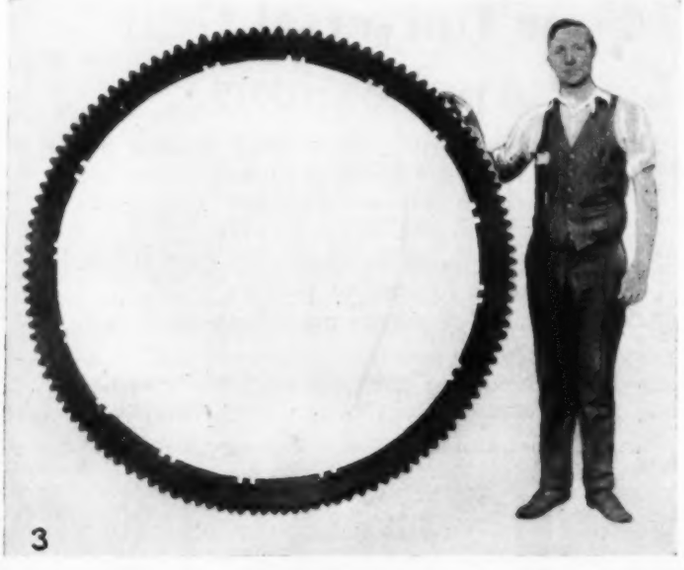


3

# Electric Locomotives

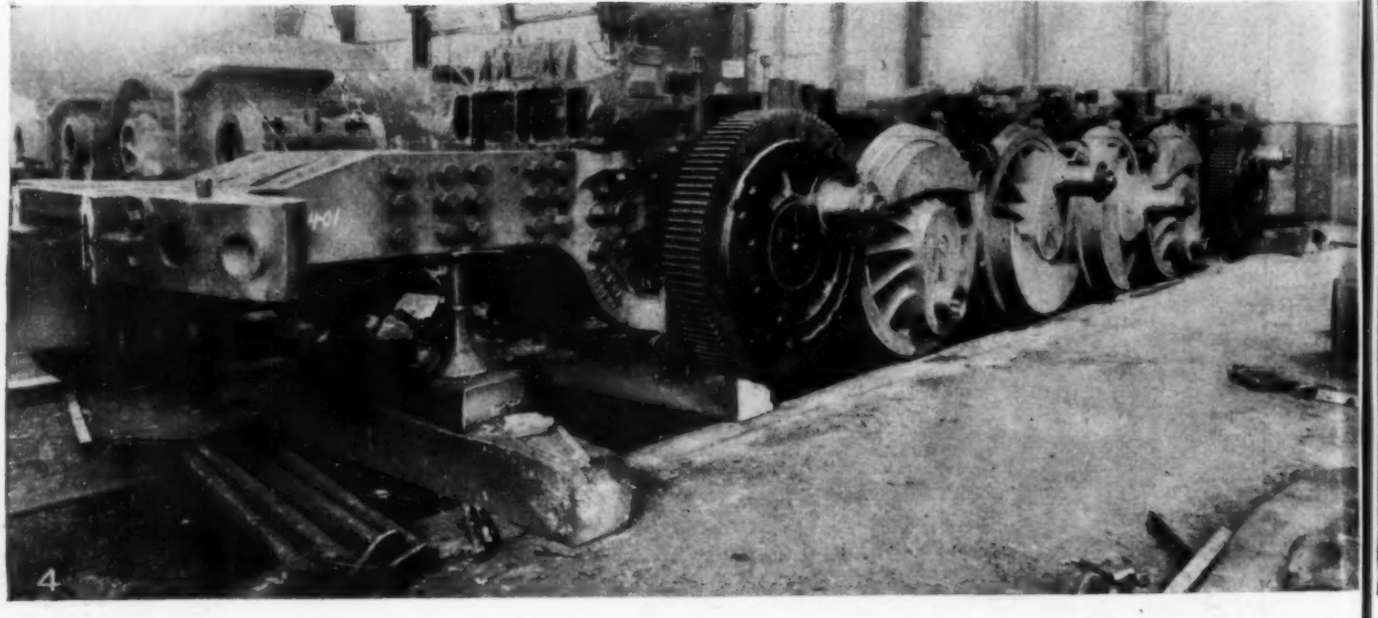
1—One of the motors—pinions on each end

2—Showing the field winding

3—A driving ring-gear

4—The gears and wheels in place

Photographs by courtesy of the American Locomotive



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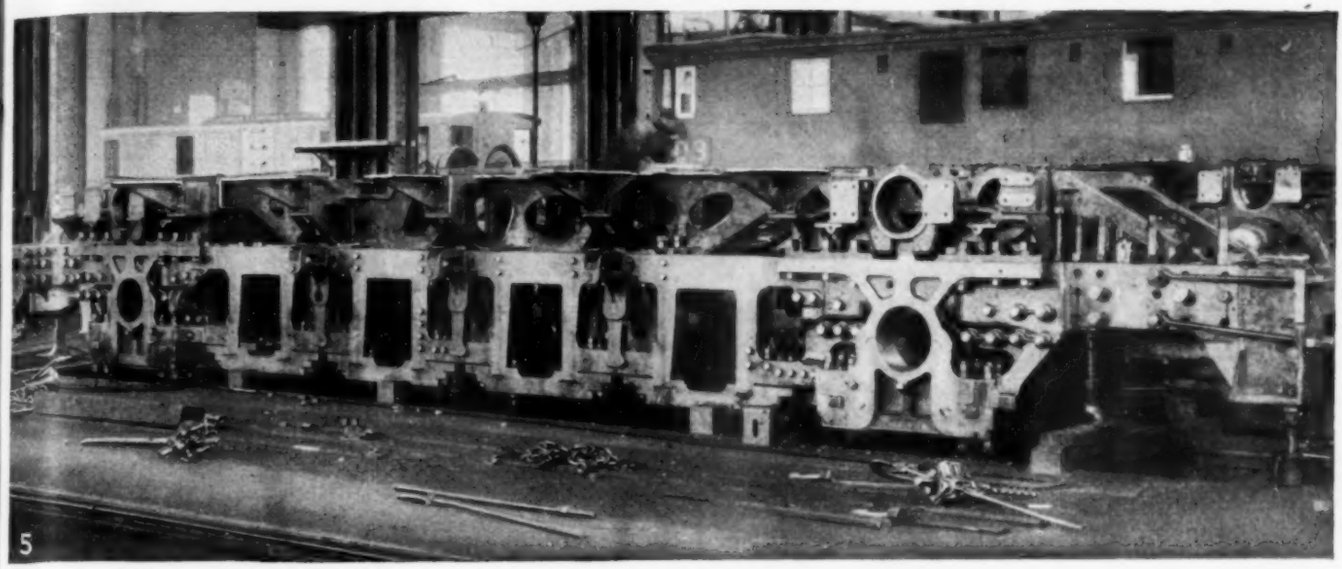

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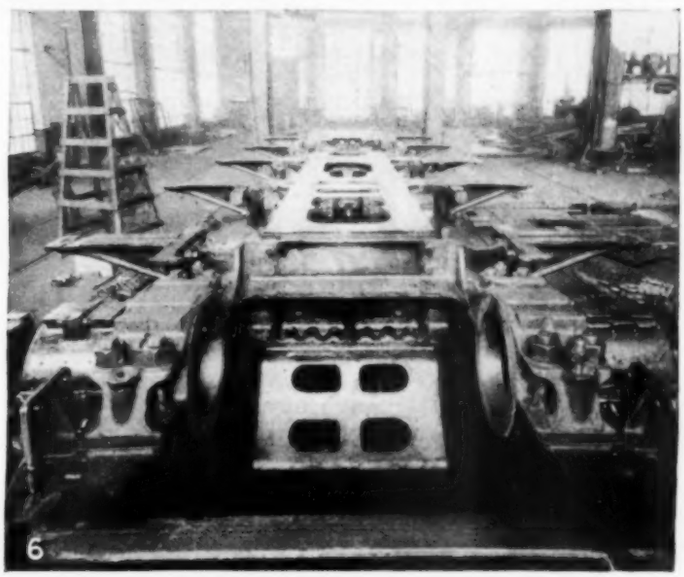
# for the Virginian



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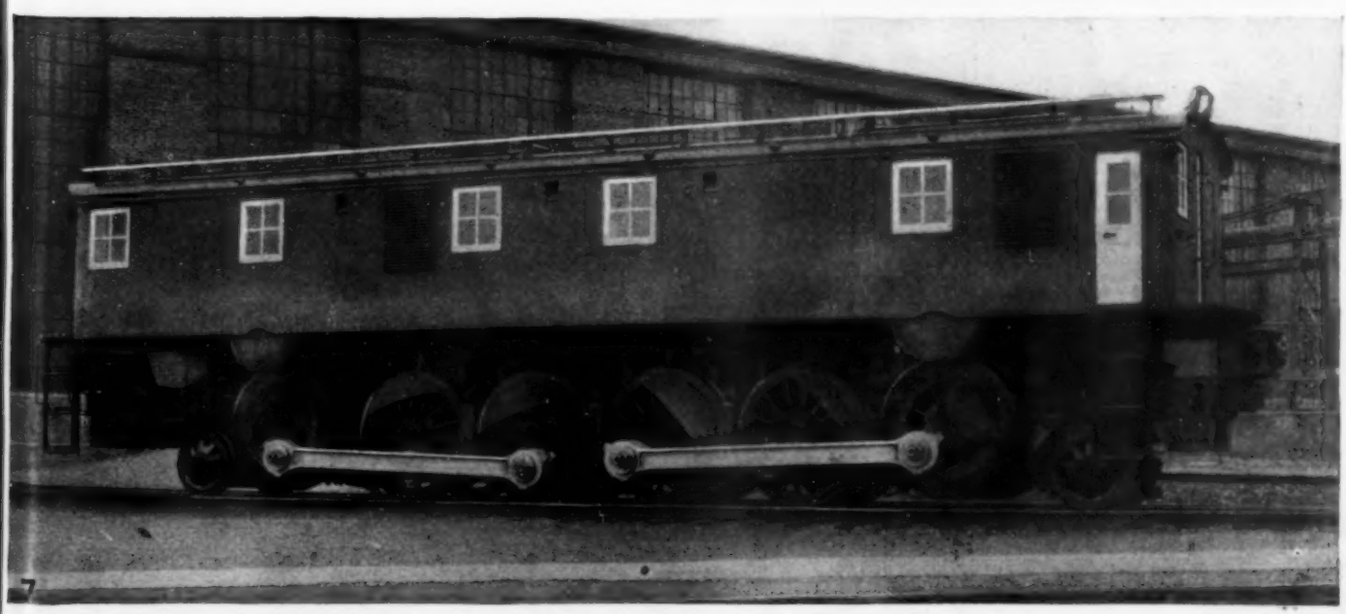
5—Frame with motor bearings and pedestals

6—Where the motor goes

7—One-third of the complete locomotive—Total length 152 ft., weight 638 tons

Works and the Westinghouse Electric & Manufacturing Co.



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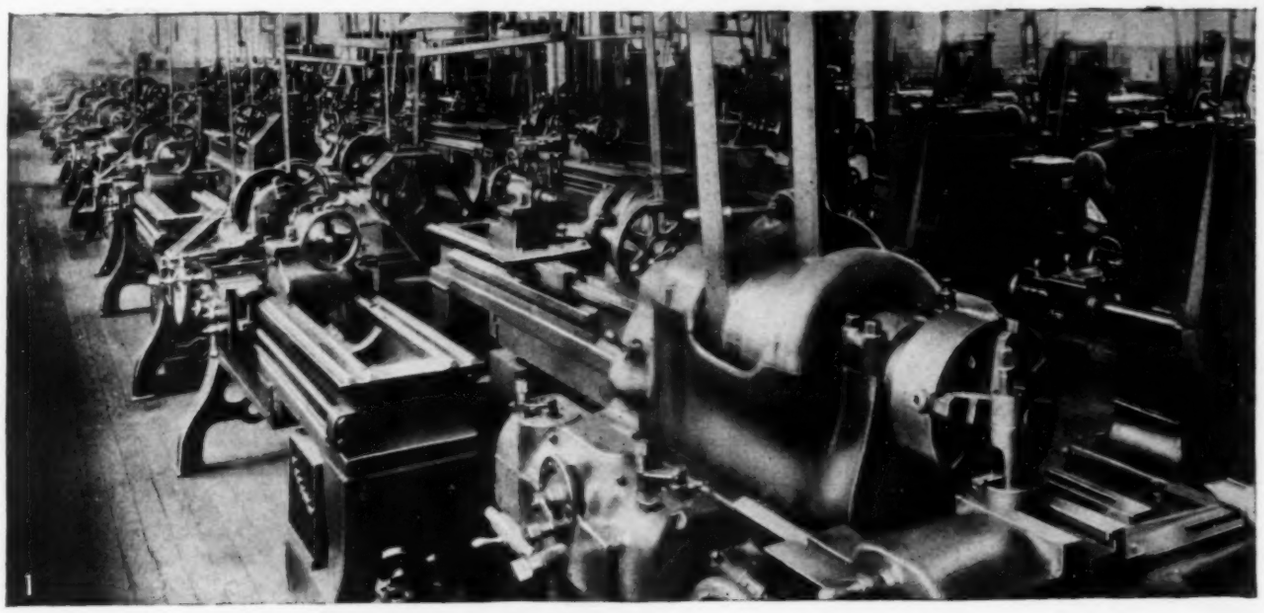
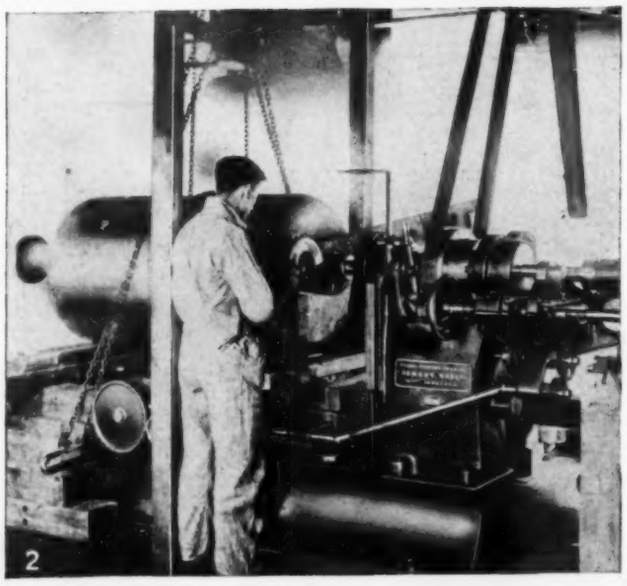




# Where Boys Learn Practical Shop Work

1—Machine shop at University of Wisconsin

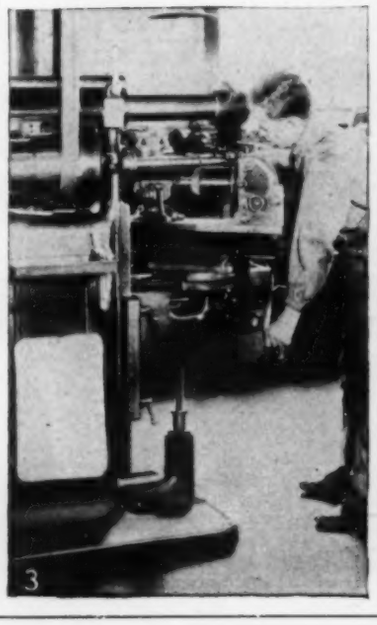
2—Horizontal boring-machine work

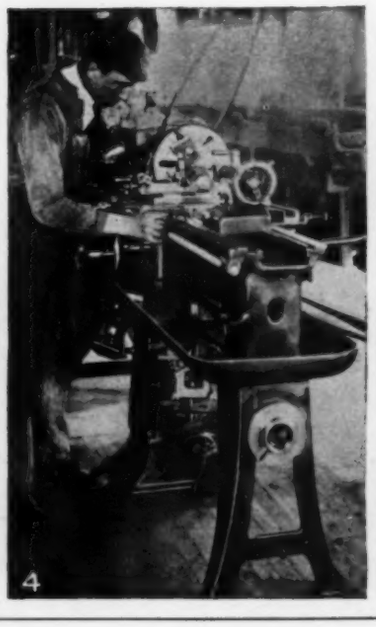
3—Cutting a helical gear

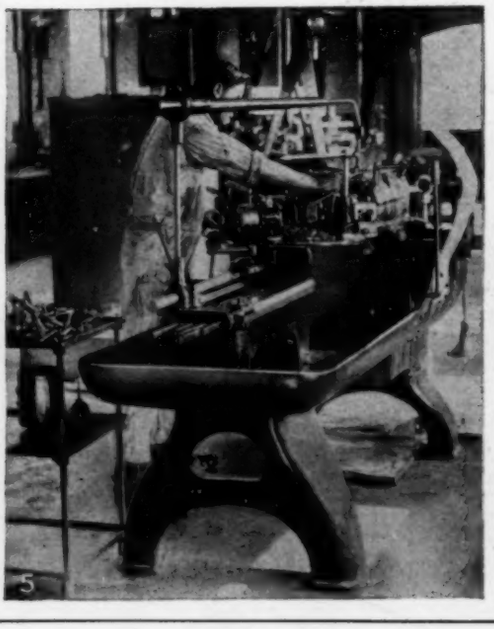
4—Button work in making fixtures

5—Turret lathe work

Nos. 2 to 5 are from the Williamson Free School of Mechanical Trades







# Operations in Manufacturing Air-Brake Pumps

**Special Correspondence**

Some of the tools and methods used in milling, boring and drilling air-pump cylinders —Old and new equipment for similar work

IT WAS approximately fifty years ago that George Westinghouse began making air brakes for railway use. Since that time, the application of air-brake equipment has become as much a part of railway transportation as the locomotive itself, and with its increased use, the manufacture has grown from very small beginning to the huge plant now occupied at Wilmerding, a few miles outside of Pittsburgh, Pa. It is of interest to note, however, that a few of the old employees are still with the company, while the "WAB" veterans of more than 21 years' service number 750, and that there are over 1,350 junior veterans who have served over ten years. Records of this kind speak volumes for the personal relations of any company with its employees and show very clearly that the spirit of fair play has prevailed throughout the organization from the very first.

### Conditions Governing the Use of Old Equipment for Some Operations

One of the conditions, we might almost say penalties, of an old organization is that it is practically impossible to entirely avoid the use of older machine equipment on some of its operations. A new concern will naturally equip with the latest machinery available, but although an old concern may continually buy new equipment it is practically impossible to have the very latest machines on all operations. This is the case with the Westinghouse Air Brake Co., and will account for some of the operations shown being performed on older type machines. And this in spite of the fact that it has bought over $3,000,000 worth of new equipment within the last three years and is continuing to renew machinery at about the same rate.

Beginning with the cylinders for the compound air-compressor, we find the ends being rough milled on Beaman & Smith and Ingersoll milling machines that carry milling cutters on both sides as well as at the top. One of these machines is shown in Fig. 1, which also illustrates the type of fixture used and shows how the feet or holding lugs are milled at the same time as the ends. The fixtures are independent units, but are placed close together so as to save space. Being separate they can be used in any desired combination and can readily be moved from one machine to another. It will also be noted that the fixtures are provided with chip pans on each side. They are made of sheet metal and hung on the sides of the fixtures by means of slotted holes that go over round-headed screws.

The end surfaces of the cylinders are finished on a Cincinnati planer, as shown in Fig. 2. No fixtures are used, the castings being clamped directly to the planer table. The end thrust is taken by two heavy stop pins and a cross bar at the front end of the row of cylinders. A broad-face finishing tool is used on the cylinder ends, as can be seen. The lugs are finished with the tool in the second head on the cross-rail.

The cylinders are bored on several types of ma-

*Fig. 1—Rough milling ends of cylinders. Fig. 2—Finishing cylinders on planer*

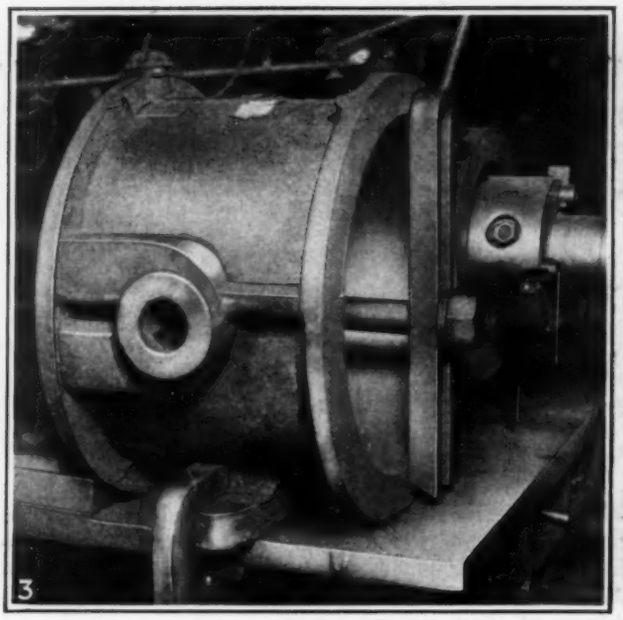


*Fig. 3—Boring a high-pressure cylinder.*

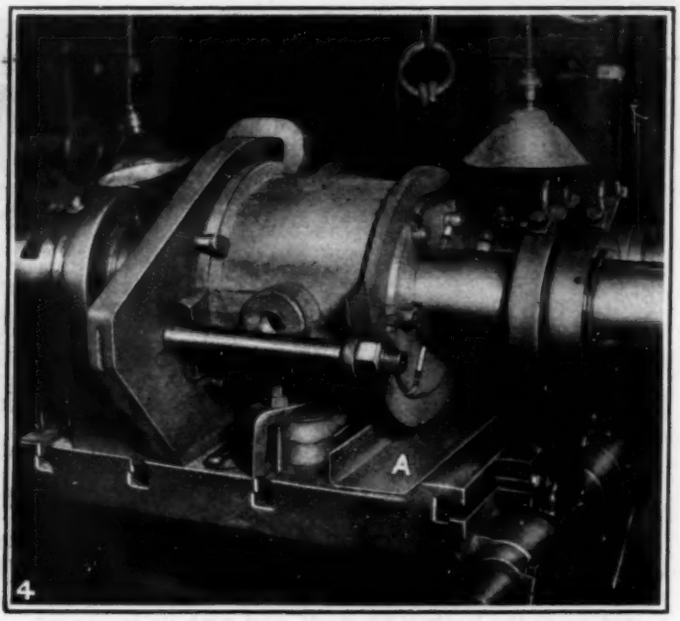



*Fig. 4—One of the double bar machines*

chines, including the old single spindle, the machine shown in Fig. 3, and large, special double-spindle machines shown in Figs. 4 and 5. In Fig. 3 the low pressure cylinder has already been bored and the cutter is at work on the high-pressure cylinder. The casting is located against an angle plate at the front end and held by means of the C-clamp shown.

One of the double-spindle boring machines is shown in Fig. 4, both cutter heads having just finished their work. The type of cutter used can be clearly seen, and it will be noted that the boring bars are large and rigid, as well as that the overhang of the cutting tool is reduced to a minimum. The method of holding the cylinder flange against the angle plate is by hook bolts and V-clamps, and it will be noted that the outer bearings for the boring bars are hinged at the bottom so as to be easily swung down out of the way when desired. When in position, they are held against the boring-machine table by the bolts shown, the socket wrench used being kept in convenient position. Here again a separate chip pan is provided at *A*, so that the boring can be readily taken care of as the cutter heads come through the bore.

The machine shown in Fig. 5 is of a different type, each boring bar being held in a separate head and the cut taken from opposite directions. Here again the cylinder flange is held against the substantial angle plate shown by means of hooks or bolts going through the plate. Adjusting screws on the top and sides make it easy to locate the cylinder in the most advantageous position.

### Drilling Operations on Flanges

The cylinder flanges are drilled under the multiple-spindle machine shown in Fig. 6. The guide plate carrying the bushings is suspended from the drilling head and allows the work to be readily handled and easily located. The holes through the feet are drilled on the two-spindle Colburn machine shown in Fig. 7, the cylinders being supported on a large pilot through the low-pressure bore and a partial pilot in the high-pressure cylinder. In addition, the outer ends are

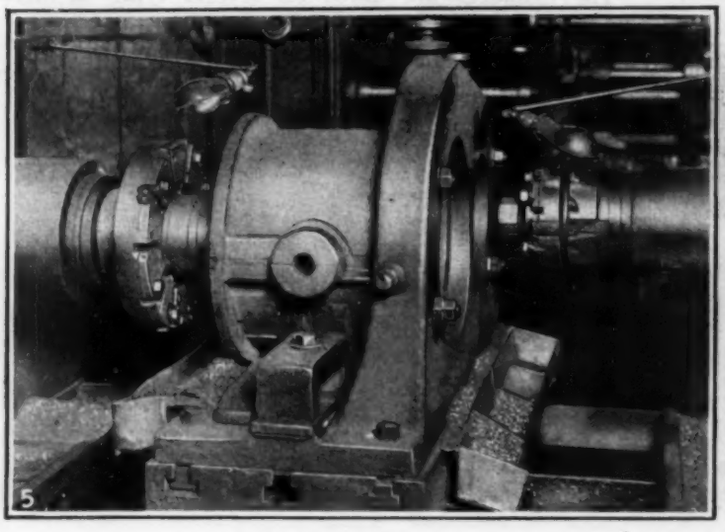


*Fig. 5—Boring in opposite directions.*

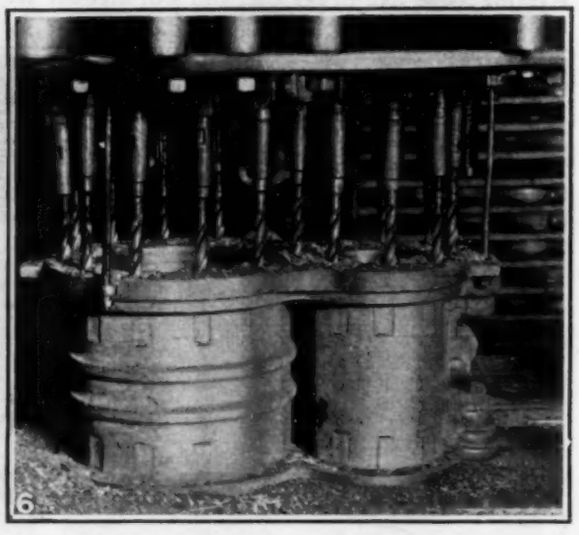
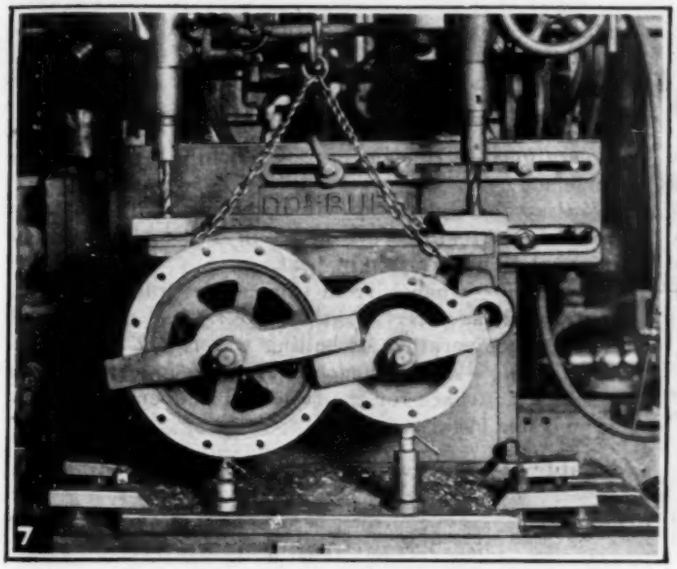


*Fig. 6—Drilling the flanges*



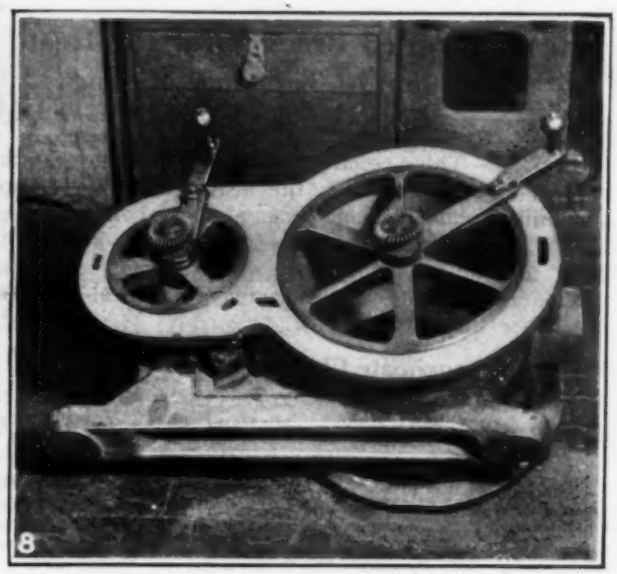


*Fig. 7—A second drilling operation. Fig. 8—Tools for cutting packing groove*

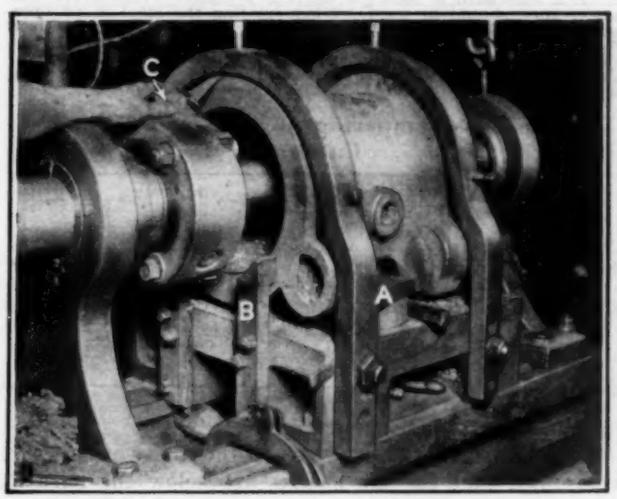
steadied by means of small screw jacks, and the side-slotted straps easily slipped over the binding bolts, allow of quick action in clamping. It will be noted that the cylinders are handled by a chain hooked over each foot, this being used in connection with an air hoist located over the machine.

In order to facilitate reboring the cylinders where it becomes necessary, a groove is cut to aid in setting up so as to maintain the same center distance between the bores. This groove is cut by the hand tool shown in Fig. 8. The center pieces that carry the revolving arms, fit into the ends of the cylinder bores and are each held by three expanding points located in the heavy arms. These points are controlled by the hand wheels in the center of each device, the wheels operating cones and forcing the points against the cylinder walls. The grooving tools are held in the revolving arms just outside the cylinder bores and can readily be removed when sharpening becomes necessary. One or two revolutions of the hand cranks is all that is necessary to cut the grooves to the desired depth.

One of the older fixtures for boring a single-pump cylinder is shown in Fig. 9. Here the cylinder is clamped at *A* by the feet after the finished face has been located against the stop *B*. Side adjustment is provided by the screws shown, the tops of the flanges being steadied by the screws in the upper part of the straps.

A very simple method of locating the cylinder is shown by the use of the gage at *C*. This is simply a V-block carrying the pointer which is set to show the outside diameter of the flange when the block rests on the outside of the boring head. By moving this block in three positions, it is easy to determine when the cylinder casting is in the proper position. The outer support for the boring bar is removable and easily swung out of the way by loosening the clamping bolt at the bottom. This is necessary to allow the cylinder casting to be put in place and removed without interference.

The simple- or single-pump cylinders are machined in much the same way as those for the compound pumps. The ends and feet are milled in fixtures strung on a planer-type milling machine as in Fig. 10, which shows the kind of milling fixture used and the construction of the milling cutters, all of the latter being of the inserted-tooth type, as is in accordance with the best practice in machine tool and manufacturing plants.



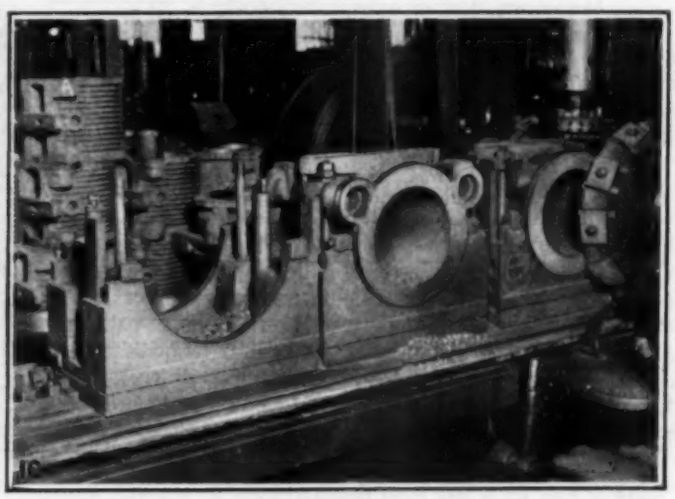



*Fig. 9—Boring a single cylinder. Fig. 10—Fixtures for milling single cylinders*

# Recommended Practice for the Heat-Treatment of Taps and Milling Cutters*

GENERAL—This recommended practice covers the process to be followed in the heat treatment of taps and milling cutters made from plain carbon tool steel, 18 per cent tungsten high-speed tool steel, and 1.5 to 2 per cent tungsten tool steel, and must not be applied to taps and milling cutters having a chemical composition other than given below.

### Approximate Chemical Composition

| | Plain Carbon Tool Steel Per Cent | 18 Per Cent Tungsten High-Speed Steel Per Cent | 1.50 to 2.00 Per Cent Tungsten Tool Steel Per Cent |
|---|---|---|---|
| Carbon | 1.00 to 1.30 | 0.65 to 0.75 | 1.00 to 1.30 |
| Tungsten | ..... | 17.50 to 18.50 | 1.50 to 2.00 |
| Chromium | ..... | 3.25 to 4.25 | 0.50 (optional) |
| Vanadium | ..... | 0.75 to 1.25 | 0.25 (optional) |
| Manganese | 0.35 max. | 0.35 max. | 0.35 max. |
| Phosphorus | 0.030 max. | 0.030 max. | 0.030 max. |
| Sulphur | 0.030 max. | 0.030 max. | 0.030 max. |
| Silicon | 0.30 max. | 0.35 max. | 0.35 max. |

### ANNEALING OF STEEL AFTER FORGING AND BEFORE MACHINING

*Operations*—Heating. Cooling.

*Heating*—Place steel in furnace on charcoal covered bottom (except high-speed steel) and heat slowly and uniformly to temperature given in Table I, and hold at this temperature for sufficient time to obtain complete penetration of heat and complete refinement of grain. It is recommended that the steel, especially the high-speed steel, be heated in a closed pipe or box containing some carbonaceous material.

*Cooling*—Cool in furnace, infusorial earth, mica, lime, or any medium that will permit uniform, slow cooling and prevent excessive oxidation.

### ANNEALING FOR RELIEVING MACHINING STRAINS

*Operations*—Heating. Cooling.

*Heating*—Place taps and milling cutters in box containing some carbonaceous material (except in case of high-speed steel). Place in furnace and heat to temperature given in Table II.

*Cooling*—Cool in furnace.

### HEAT TREATING OF TAPS AND MILLING CUTTERS

*Operations* — Heating for Quenching. Quenching. Tempering.

*Heating for Quenching*—Heat taps or milling cutters uniformly to temperature given in Table III and hold for complete penetration of heat.

*Quenching*—Quench from this temperature in water, brine, or oil as directed in Table III, but do not cool below the temperature of boiling water, 212 deg. F.

*Tempering*—After quenching, reheat immediately in oil, salt, or furnace for the time and temperature specified in Table IV.

### Table I—Annealing After Forging and Before Machining

HEATING

| Type of Steel | Method | Temp., Deg. F. | Time of Heating to Uniform Temp. | Time of Holding at Temp. | Cool in |
|---|---|---|---|---|---|
| Plain carbon | Pack anneal or on charcoal bottom | 1,450 | 1 hr. per in. of dia. or thickness† | ½ hr. | Furnace‡ |
| 18% Tungsten High Speed | Non-oxidizing atmosphere | 1,600 to 1,650 | ½ hr. per in. of dia. or thickness | ½ hr. | Furnace |
| 1.5 to 2% Tungsten | Pack anneal or on charcoal bottom | 1,475 | 1 hr. per in. of diam. or thickness | ½ hr. | Furnace |

†When pack annealing, consider the container and contents as one unit.

‡If lead bath or salt bath is used for heating, cool in lime, mica, or infusorial earth.

*This is a tentative Recommended Practice approved by the Recommended Practice Committee of the A. S. S. T., and will remain tentative until it is adopted by the Recommended Practice Committee and the Board of Directors. The committee was composed of four users and three manufacturers, as follows: Users, W. J. Merten, chairman, C. I. Neidringhaus, W. H. Phillips, DuRay Smith; Manufacturers, C. M. Johnson, J. Trautman, Jr., and J. P. Gill.

### Table II—Annealing for Relieving Machining Strains

| Type of Steel | Heating: Temp. Deg. F. | Heating: Time of Heating to Uniform Temp. | Time of Holding at Temp. | Cool in |
|---|---|---|---|---|
| Plain Carbon | 1,400 | 1 hr. per in. of dia. or thickness | ½ hr. | Furnace |
| 18% Tungsten High Speed | 1,500 | 1 hr. per in. of dia. or thickness | ½ hr. | Furnace |
| 1.5 to 2% Tungsten | 1,450 | 1 hr. per in. of dia. or thickness | ½ hr | Furnace |

### Table III—Heating and Quenching of Taps and Milling Cutters

| Type of Steel | Preheating: Medium | Preheating: Temp. Deg. F. | Heating Medium or Type of Furnace | Heating for Quenching: Temp. Deg. F. | Heating for Quenching: Time | Quenching: Medium | Quenching: Temp. Deg. F. |
|---|---|---|---|---|---|---|---|
| Plain Carbon | ..... | ..... | See Footnote 1 | 1,425 to 1,450 | 1 hr. per in. of dia. or thickness | Water or Brine | Water 70 |
| 18% Tungsten High Speed | Open furnace | 1,500 to 1,550 | Open furnace | 2,250 to 2,300§ | See Footnote 2 | Oil | 70 |
| 1.5 to 2% Tungsten | ..... | ..... | ..... | 1,450 to 1,475 | 1 hr. per in. of dia. or thickness | Water or Brine | Water 70 |

1. If a lead bath is used for heating, a higher temperature and shorter time should be used. When heating the steel in an open furnace, either an indirect fired furnace (muffle) should be used or a smoky flame should be maintained.
2. Hold shortest time possible to thoroughly heat through.
§A temperature as high as 2,350 deg. F. may be used providing the furnace design is correct and the atmosphere is suitable.

### Table IV—Tempering of Taps and Milling Cutters

| Type of Steel | Results Desired | Tempering Medium | Tempering Temp. Deg. F. | Time |
|---|---|---|---|---|
| Plain Carbon | See footnote 1 | Oil | 325 to 500 | ½ to 1 hr. |
| 18% Tungsten High Speed | See footnote 2 | Furnace | 1,100 to 1,200 | 30 min. |
| 1.5 to 2% Tungsten | See footnote 1 | Oil | 325 to 500 | ½ to 1 hr. |

1. Depending on degree of hardness or toughness desired.
2. Development of secondary hardness and toughness.

NOTES ABOUT THE PROCESS—In the above practice it is assumed that the tap shanks are below the hardening temperature and are not fully hardened. If the shanks have been hardened they must be tempered.

# More About Turbine Blades

**By Fred H. Colvin**
Editor, *American Machinist*

A second article taking up the making of different types of blades and showing other methods and inspection fixtures —Assembling blades in turbine rotors and cylinders

SOME of the steel turbine blades are considerably shorter than those shown in the previous article, as can be seen in Fig. 1, while Fig. 2 shows a pair of phosphor-bronze reaction blades, made from rolled or drawn stock, in several stages of manufacture. The blanks are shown at the right, the blades in the center showing the up-setting operations, and those at the left, the blades after being milled at the ends and drilled. Fig. 3 shows the process of the rolling and drawing, beginning with the round rod at the left and indicating the various stages up to the completed cross-section of the blade at the right.

A portion of the rolling mill is shown in Fig. 4, and a small self-contained mill and reel in Fig. 5. The rolling operations reduce the rods to approximately the desired shape, the final shape being secured by drawing the rods through suitable dies, as shown in Fig. 6. The method of operation can readily be seen, as well as the construction and operation of the rather heavy draw bench.

The smaller sizes of the drawn material for the blade come in coils to the upsetting or heading machines shown in Fig. 7. By means of special dies, these machines upset and form the ends so as to require very little machining, although the section of the shop where this is done, Fig. 8, indicates that several machining operations are necessary. The comparative size of the blades can be seen by the tote pans used, indicating that they are decidedly smaller than the forged blades illustrated in the previous article.

The profiling of a thin edge on one end of one of the small blades is shown in Fig. 9, where a very ingenious fixture has been permanently mounted on an old-type milling machine that would otherwise have been put on the pension list. The milling machine simply provides motive power for turning the cutter and also support for the fixture shown.

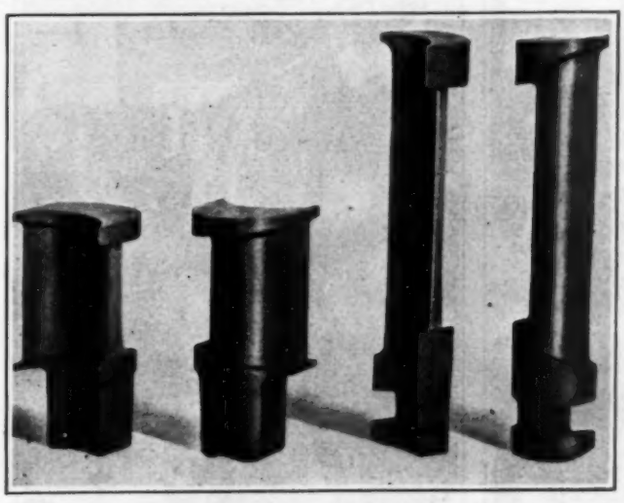


*Fig. 1—Two short impulse blades*

The pieces to be milled are held in the rotary part of the fixture, one just being inserted by the operator at the top of the drum. The formed surface of the drum is kept in contact with a hardened-steel roller on the cutter arbor, by means of air pressure in the cylinder at the right, the piston of which is connected to the slide carrying the drum. The former is composed of a series of movable shoes under which the blades are

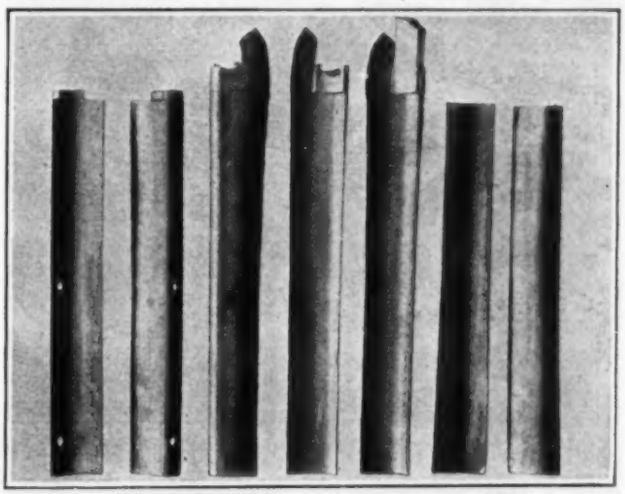
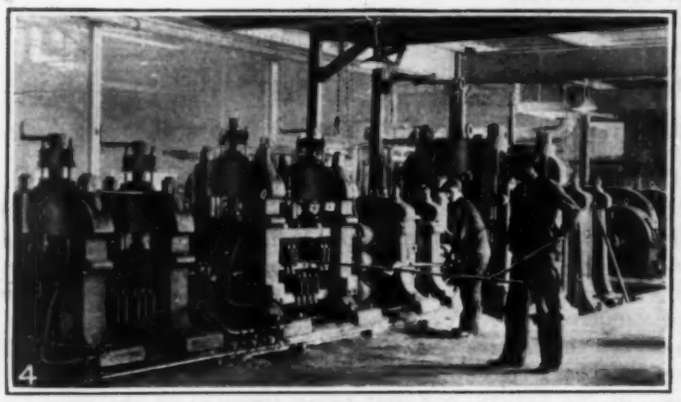


*Fig. 2—Reaction blades in various stages*

placed, leaving the parts to be milled exposed. Thus, in forcing the former against the roller, the blades are held in milling position and are compelled to pass the cutter in a path of the same profile as that of the former.

Another fixture in this department, shown in Fig. 10, is for cutting the notches at *A* in the small packing or calking pieces at *B*. The blanks are inserted at *C*, and when the punch descends, the bar *D* forces the clamping bar *E* to the right and holds the blanks firmly while the broach *F* cuts the notches. The small size of the blank would make it difficult to hold in a milling fixture, but the fixture described accomplishes the desired end without difficulty. The pieces are automatically blown out of the fixture by an air jet delivered through the pipe at the left.

In Fig. 11 may be seen one of the inspection gages for testing blades for small rotors, both as to angle and



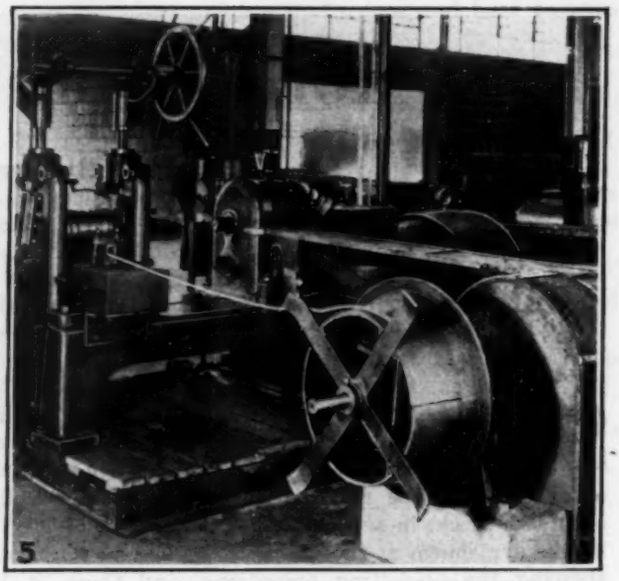


*Fig. 3—Progressive rolling of sections. Fig. 4—Some of the rolls. Fig. 5—A small rolling machine*

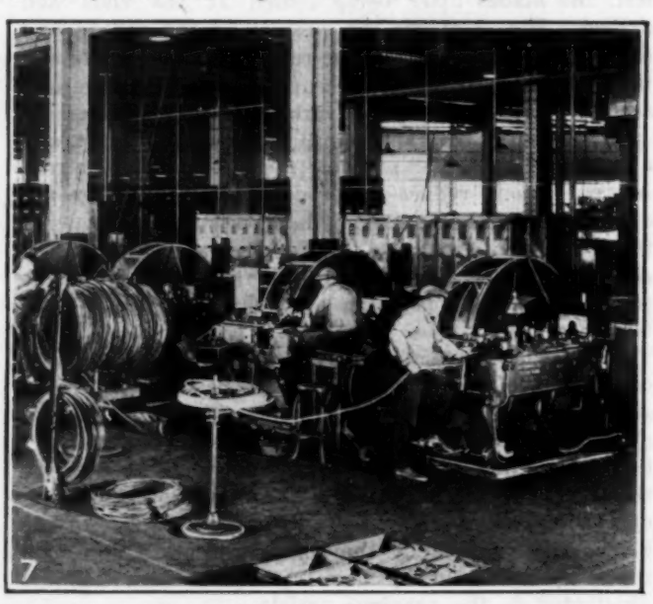


*Fig. 6—Draw bench for large sections. Fig. 7—Upsetting ends of blades*

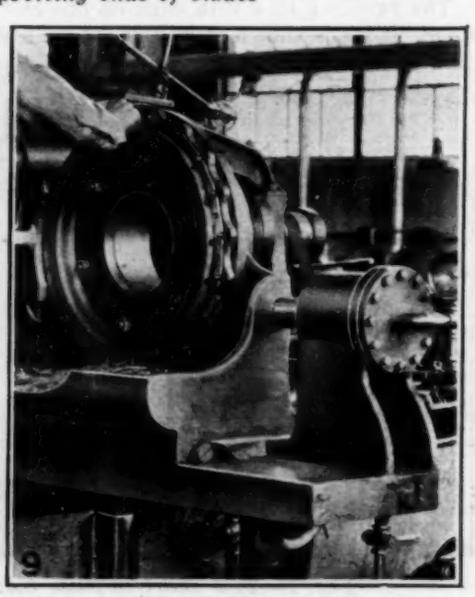


*Fig. 8—Machining reaction blades. Fig. 9—Special profiling fixture for blades*

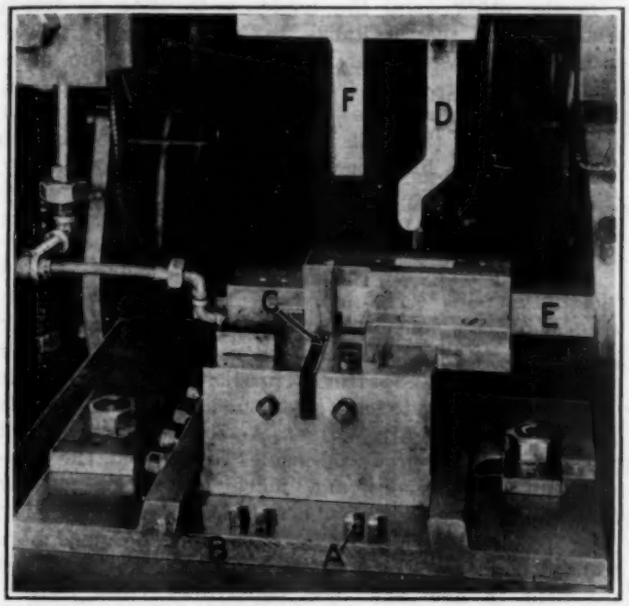



*Fig. 10—Broaching fixture for retaining blocks*

width. The importance of both these factors will be understood when it is considered how many blades are necessary to make up a single row in a large rotor, and how much a slight variation, either in angle or width, will affect the fit as the blade assembly nears completion. The graduations show thousandths of an inch differences in width, and the position of the blade indicates how much it is above or below normal.

A model, showing assembly of stationary blades in a taper-bore cylinder is to be seen in Fig. 12, which also indicates the kind of packing used between blades of this type. Both the blades and the packing are held in the groove by the notch shown at *A*, and by the calking strip *B*, which is driven in place and holds them firmly in the groove in the cylinder or stationary member. The holes in the blades are for the lashing wires as shown in Fig. 13. This view also shows another type of packing that is itself a wedge, and when calked in place holds the blades firmly in position.

The way in which the blades are assembled and threaded over the lashing wires is shown in Fig. 14, which gives a good idea of the size of a turbine of even small horsepower. The blades and packing pieces at *A*,

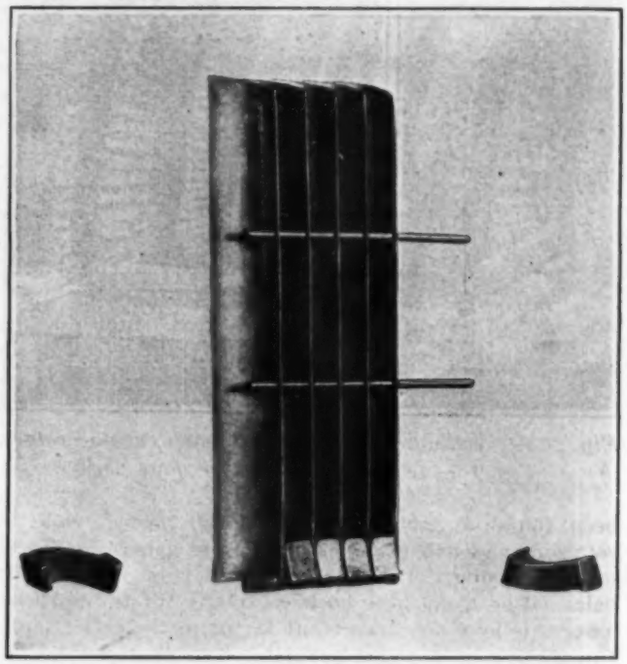


*Fig. 13—How reaction blades are assembled*

together with the shape of the grooves into which they are set, give a good idea of the construction. The ends of the grooves are filled with suitable protecting pieces, and when the two halves of the housing are bolted together there is no opportunity for displacement, except through a blade of the rotor coming loose or breaking.

The high speeds at which the turbine rotors run,

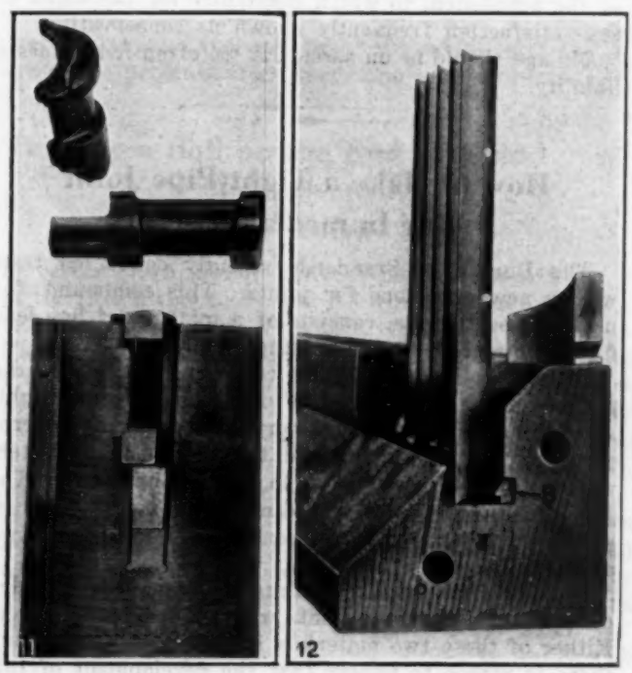



*Fig. 11—One of the inspection gages. Fig. 12—Testing assembly of manganese blades*

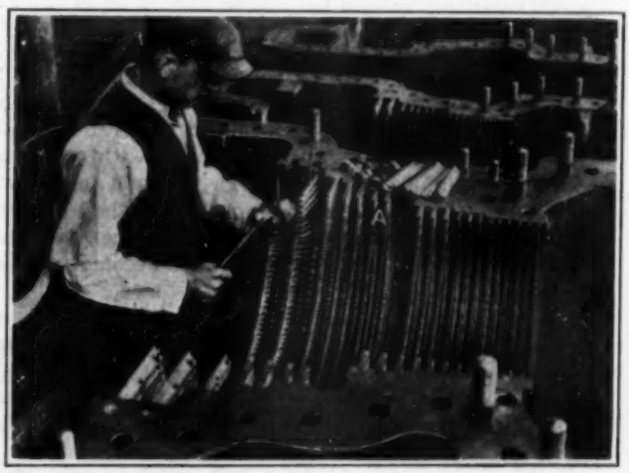



*Fig. 14—Inserting blades in small turbine cylinder*

make accuracy of balance of extreme importance. After the rotor has been lowered in position, the concentricity of its body is tested with the dial indicator shown in Fig. 15. The indicator is mounted on a wooden frame, the contact or feeler rod being inclosed in a tube. It is so mounted that it may reach between the rows of blades and contact with the body of the rotor itself.

Fig. 16 shows the whole gage mounting and the contact point. These views also show very clearly how the rotating blades nest together and the way in which the lashing wires go through the blades at different points. The lashing wires are not continuous, but are divided into segments to provide for expansion. They have

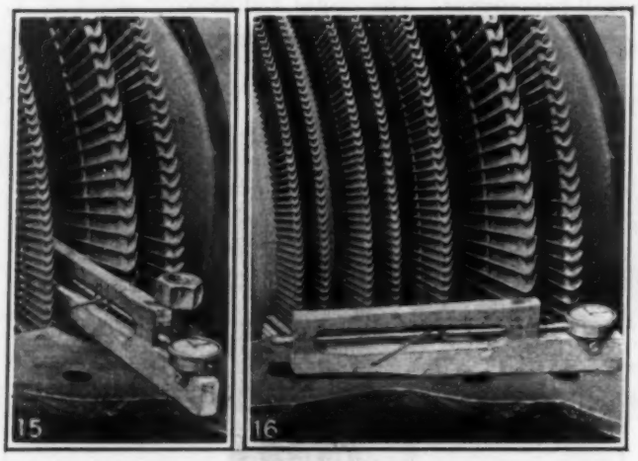



*Fig. 15—Checking concentricity of small turbine rotors.*
*Fig. 16—Temporary indicator gage used*

been found to materially steady the blades while in rotation, and add considerably to the general stiffness of the construction. The completed rotor is carefully balanced on a machine built especially for the purpose, since this is a very important factor in the satisfactory functioning of a steam turbine. The photographs are from the South Philadelphia plant of the Westinghouse Electric & Manufacturing Company.

# Seen and Heard

By John R. Godfrey

## *Is age an asset or a liability?*

Just how much is it worth to a concern to be able to point with pride to 50 or 100 years of existence? Is "established in 1815 or 1825" an asset or a liability?

It is the tendency of youth to be radical—to try new things, and of old age to be conservative—to resent or fear change. It seems to be the same with concerns as with individuals. For, though the old members of a concern die off and younger men take their places, this seldom happens till the "younger" men are no longer really young, or before they have become imbued with the traditions of the older men.

Many devices and ideas have failed because they were improperly tried, or because the time was not ripe for their success. "We tried that once and it didn't work" has caused many an old concern to pass up a paying proposition, only to see someone else work it and make it earn large dividends.

Traditions of old established businesses are fine things to talk about—and it gives a customer a feeling of security to know that he is buying from an old, reliable concern. He is sure to receive square treatment and to get a reliable product, be it a machine or a pair of overalls. And for that reason, if for no other, a certain clientele clings to the old established line of manufacture. It deserved the reward for long continued service.

On the other hand the tendency to cling to tried products and the hesitancy in bringing out radical designs, is very marked in most firms that are even twenty-five years old. Take any old established firm you know of, in any line, and compare the new designs brought out in the first fifteen years of its existence with those that have been evolved in the next thirty years. It's dollars to doughnuts that the designs of the first period have it all over the ones of the years that have passed since then.

There are many perfectly natural and sound reasons for this change. New machines are designed and developed by new concerns to wrest a market from their older competitors. This costs money in the developing and tooling up, and after a product is established it becomes necessary to cash in on the design before again facing the cost of a new line. As the years go by and the success of the product becomes established, the management grows more and more averse to putting radically new designs on the market. The tendency to stick to older designs for "one more year" becomes more marked, and as a result, the concerns that once led the field in new and bold departures from conventional design, are very apt to become followers instead. Other new concerns with reputations to make, bring out new designs that take the buyer's fancy, and the older firms are compelled to follow, usually more or less half-heartedly.

Both designers and users of machinery of various kinds seem to be agreed that really radical designs are to be found most frequently in new concerns. Unhampered either by tradition or capital invested in patterns, tools and fixtures, the small concern can and does strike out into new fields, and frequently brings out a design that changes the complexion of the whole industry, compelling even the older builders to follow suit.

Perhaps this is one of the compensations that nature hands out to the young and struggling concern as an offset to the advantages of prestige and reputation. And it behooves those who wish to stay in the front of the procession, to watch constantly for the signs of self-satisfaction frequently known as conservatism.

Old age should be an asset, but too often it becomes a liability.

# How to Make a Tight Pipe Joint for Immediate Use

The Bureau of Standards recently conducted tests with a new pipe dope for joints. This compound, for use on pipe threads, consists of a mixture of fine lead filings or zinc dust, and cutting oil.

The joints made with this compound for a pipe did not have to be allowed to "set" in order to become tight, as is the case with the ordinary paste. In the government tests, the joint proved to be tight immediately under a pressure of 8,500 lb. per square inch. The joints made with paste leaked under a much lower pressure even after they had been allowed to set for two and a half weeks.

The performance of the joints made using lead filings differed little from the joints where zinc dust was used. Either of these two materials is readily obtainable and there is reason to believe that the development of this compound will be of real value.

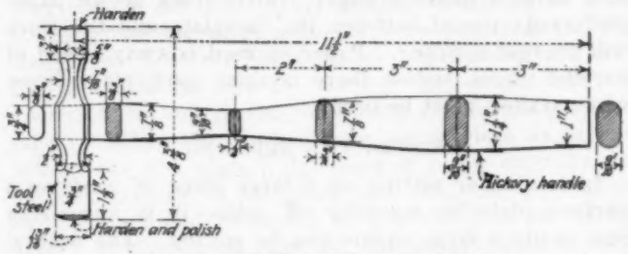
# Ideas from Practical Men

**The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit**

## Hammer Design

By H. L. Wheeler

Many mechanics like to make their own tools, incorporating in them, as a rule, some distinctive features not found in commercial tools. A common tool that many mechanics do make for themselves is a hammer. The design shown herewith has some features of unusual merit and has a "feel" that is distinctive. A




*A hammer designed by a toolmaker*

toolmaker made this hammer, and I admired it so much that it seems worth passing along to those who like to make such things for themselves.

The hammer-head is beautifully finished by hand after turning the ends. It is then tempered and fitted to the handle. The edges are beveled about 45 deg. and harmonize with the contour of the middle section. The ends are polished after hardening and tempering.

## Turning a Ball on the End of a Rod —Discussion

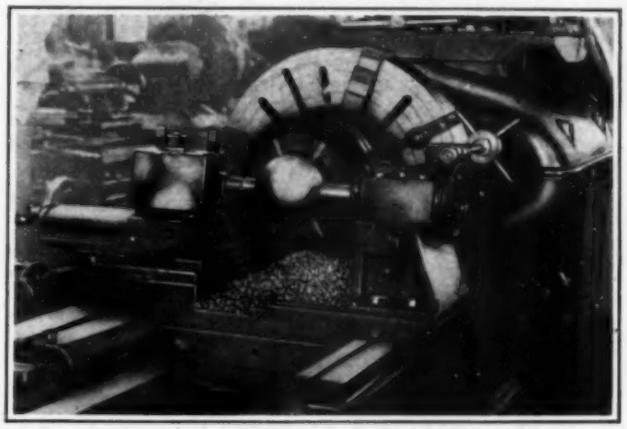
By T. B. Sitzler

The device illustrated by Milton Wright in an article under the title given above and published on page 783, Vol. 62, of the *American Machinist*, works out well. I used a similar rig some years ago except that I used three cutters instead of one. Of course the balls were not of small diameter.

I am using at present an adaptation of the same scheme to turn balls 6½ in. in diameter with 1¼-in. reamed holes through the centers. The balls are true spheres clear to the edges of the holes. The common method of doing this class of work is to put the ball on an arbor between centers and swing the tool radially around a point located under the center of the ball.

Sometimes, if the diameter of the ball is small enough, the pin in the compound rest is used to swing the tool. I have seen and used worm-gear drives for larger balls, but in every case the tool post strikes the arbor before the cut is completed. This interference causing three settings of the tool is a source of inaccuracy as well as being slow.

The device I am using at present is illustrated in the photograph. It consists of a worm gear driving a quill, an arbor, a piece of tool steel with a 60-deg. center



*Mounting of ball on lathe for machining*

and a cutter head carrying six tools. There is only one point to be careful about and that is that the center line of the arbor exactly bisects the center line of the lathe. If this is done the device will turn a true sphere. We get a gas-tight joint without grinding. Note that the arbor is locked in the driving quill with a setscrew. Also note the method of feeding the ball by a star feed.

## How to Lap a Micrometer Spindle

By W. H. Ladd

The spindles of micrometers become worn out of square after long continued use and do not make perfect contact with their anvils. To true up a worn spindle-end is a simple matter and one that requires but very little time.

Make a fiber bushing at least ½ in. in diameter by ½ or ¾ in. long, with the hole carefully reamed to fit rather tightly over the spindle, and one end faced square. Remove the spindle from the micrometer and insert it in the bushing, letting the end come about flush with the faced end.

Lap the spindle on a cast-iron plate, using flour abrasive and gasoline. Replace the spindle in the micrometer and test with the anvil. If the latter is worn also, it may be replaced cheaply by a new one.

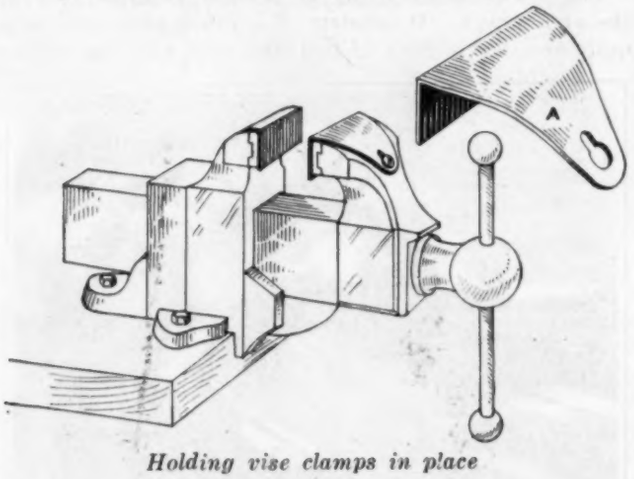
# IDEAS FROM PRACTICAL MEN

## Anchoring Vise-Clamps

By E. N. Davey

There are few mechanics who do not have occasion to use the familiar type of vise clamps, or soft jaw-faces shown in the accompanying sketch. Though the clamps may be made of a variety of metals and in many ways, they all have a habit of "jumping the traces," so-to-speak, at the exact moment when one wants them to stay put.

After laying out the position of the small screw holes, central with the jaws and sufficiently far back so that the screws cannot interfere with the normal use of a file upon work to be held in the vise, drill and tap for




*Holding vise clamps in place*

No. 10-32 round-head screws. The holes need not be more than ¼ in. deep, and when the clamps are not needed it is but the work of a moment to remove them and replace the screws so that the holes may not become clogged up.

To elaborate a little upon the idea a clearance hole may be made in each of the clamps and a slot filed, as at *A*, so that the clamps may be removed and replaced without taking out the screws.

The idea is by no means new, but one seldom sees it in practice. The writer has used clamps made as described for many years and finds that they have paid for themselves, not only in time saved, but in avoiding those exasperating moments when the whole works fly out of control just as the work is about to be placed.

There need be no misgivings about weakening the vise jaws, as the holes are very small and not very deep.

## The Use of Paper in the Machine Shop

By J. Davies
Oshawa, Canada

It is really surprising when one stops to think about it, what a useful commodity paper is in the machine shop. I suppose it is because paper is cheap and common that we do not realize its usefulness. Also because it is not usually associated with machine shop work. It is my purpose in this article to enumerate a few of the uses in the machine shop as they occur to me.

First, I will mention shaper and planer work. In machining a piece of work such as a match plate for the pattern shop, it is necessary to take the rock out of the casting before bolting it down. Otherwise the bolts will spring the work, and when they are loosened the casting will spring up again and the surface will not be flat. Paper is a very good thing to pack up the irregular places, so that the job will lie flat on the shaper table. A thin strip of paper is practically non-compressible, and has no spring in itself.

Of course, if the job is very crooked it may have to be packed up with other packing, but in that case it would have to be turned over more than once, and strips of paper, carefully cut, cannot be beaten to pack up the job for the final setting. Again, the jaws of very few planer or shaper vises are parallel, and parallel strips of paper the length of the jaw and about ½-in. wide, placed one at the top and the other at the bottom of the jaws, make an excellent method of overcoming the irregularities. In bolting a job to the faceplate of a lathe, a piece of paper (fairly thick brown paper preferred) placed between the faceplate and the work will prevent slipping. Paper so used is away ahead of parallel pieces, unless there is some particular reason why parallels must be used.

### Accuracy in Squaring

In testing or setting up a large piece of work on a surface plate or marking off table, it is surprising how easily a large square can be sprung. The natural tendency is to push the blade of the square against the work, and try to fool oneself that the work is square, while as a matter of fact the blade of the square has been sprung anywhere from two to ten thousandths of an inch. A very accurate test for work of this character is to cut two strips of paper about ½ in. wide, the thinnest that can be obtained, and place one at the top of the square, and the other at the bottom. Then lightly press the square against the paper, until it holds one or both strips in place. If the square tightens on one strip and not on the other, the work is evidently not square. If it holds both strips in place, move each one separately between the square blade and the work, and note if they both have the same tension. If there is the slightest tendency to spring the blade, it will grip one or the other of the strips of paper, and they can not be pulled without tearing.

In many cases, strips of paper can be used as feelers to better advantage than the regular steel feelers. In testing work with a surface gage where it is necessary to have a long reach, it is hard to tell when the gage is just touching the work. By placing a paper feeler under the gage and working it backwards and forwards, it will tell exactly, because the moment the gage is pressed too heavily on the paper, it tears. Paper is a very useful commodity for making washers for abrasive wheels. Abrasive wheels should never be mounted without paper washers under the steel ones. Paper washers are also very handy for spacing cutters for straddle milling.

What lathe hand has not wrapped a piece of paper around the tailstock center of his lathe at some time or other, to tighten it or make it stand out from the tailstock a little further. Paper is very useful when

# IDEAS FROM PRACTICAL MEN

babbitting bearings. I used to get some nice, thin, waxed paper from the candy factory to wrap around the cold-rolled shafting used when babbitting. It usually made a nice smooth job and saved a lot of scraping. I have often thought that if some paper manufacturer would make special, oiled or waxed paper in rolls, perforated and gummed to suit the different sizes of shafts, and of proper thickness for the given size of shaft, it would be a great boon to the machine shop, as then the workman could tear off a piece suitable for the given diameter and cut it to the length of the bearing. Also, if a stock of thick paper collars were kept on hand, with holes in them the same size of the shaft, to be placed between the iron collar and the bearing, it would be a great benefit.

Sometimes paper can be used to advantage in transferring the location of holes from one piece of work to another, by placing the paper on the work and rubbing it over with the hand, then pasting or gumming it onto the other piece of work, when the holes will be very clearly outlined. This method could not be used if any great degree of accuracy were required, but for many jobs it serves the purpose. In making and setting up blanking dies for cutting thin stock, paper is a very convenient means for testing the accuracy of the set-up. When the die has been set as close as can be told by the eye, place a flat piece of paper over the die without creases or wrinkles and trip the punch, or perhaps it would be better to pull the first stroke by hand. If the punch cuts out the paper blank cleanly all around, the set-up is accurate.

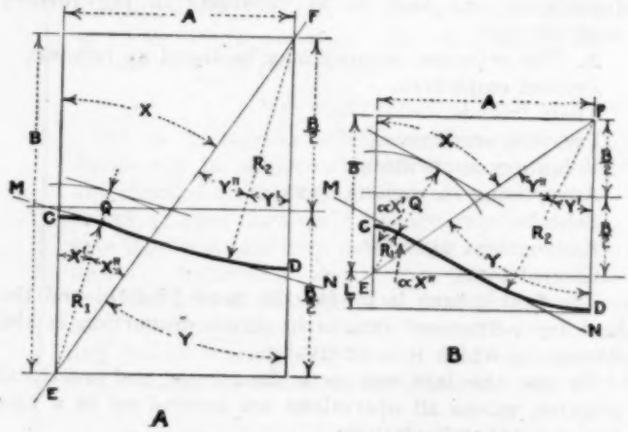
Don't try too many thicknesses of paper. A number of thicknesses of paper will break a punch much more readily than will an equal thickness of metal.

## Formula for Unequal Reverse Curves

By F. W. Miller

The following is a companion method to the reverse-curve formula which appeared on page 570, Vol. 62, of the *American Machinist*. It can be used for calculating the length of a compound line made up of two reverse curves connected by a tangential straight line, when the radii and centers are known.

The illustrations, *A* and *B*, represent two examples of solutions by this method.




*Diagrams for long and short radii*

Given the line *CD* whose length is desired, and whose radii and centers are known, draw the line *EF* through the two centers. Let *EF* be the diagonal of the rectangle *AB*, drawn so that the point *C* will lie on one of the sides.

Find the angle *X* in degrees, minutes and seconds. $Y = X$. $R_1$ and $R_2$ are perpendicular to the tangent *MN* and parallel to each other. Also *X'* and *Y'* are equal angles.

$$\frac{R_1 + R_2}{2} = \text{the mean radius} = R_1 + Q.$$

Solve the triangle having $\frac{EF}{2}$ for its hopythenuse, and $R_1 + Q$ or the mean radius as its adjacent side. Find the value of *X''* and subtract it from *X*. The remainder equals *X'* and *Y'* also.

Find the value of the arc defined by radius $R_1$. Also that of the arc defined by radius $R_2$, both arcs either in inches or feet.

The tangent connecting the arcs is the sum of the sides opposite *X''*, having $R_1$ as its adjacent side and *Y''* having $R_2$ as its adjacent side.

The length of the line *CD* will be the sum of the arcs and the tangent.

When the point *D* falls outside of the rectangle, the external arc may be ascertained and added to the portion of the line *CD* included in the rectangle.

## Repairing Micrometers—Discussion

By W. A. King
Birmingham, England

The article under the title given above, by H. J. Gustav Kopsch, and published on page 357, Vol. 62, of the *American Machinist*, emboldens the writer to relate the experience he has gained in the wear of micrometers and the necessity for their frequent adjustment in the works with which he is connected.

In much of the production work in which extreme accuracy has to be guaranteed, it has been necessary to keep operators constantly "miking" the work, and the wearing and consequent need of re-adjustment of micrometers of the ordinary type has been the cause of much expense and annoyance, to say nothing of work spoiled because the damage occurred before the wear of the micrometers had been detected.

A great advantage has been gained by changing to spring micrometers of the dial type. Although working with a dial graduated in millimeters, we find that we can "mike" at least five times the number of pieces in an hour that we can handle with the micrometer of the ordinary type.

The latter, is, of course, the more accurate of the two, but the former answers our purpose very much better and it pays us to run along in this way, checking the spring dial micrometer with the standard, which latter instrument we are inclined to think is best kept in the hands of the foreman on control official.

Without doubt, in England we have gotten into rather a slack system generally, in allowing workmen to make rough and ready usage of high-class micrometers intended for exclusive use in the control offices.

# Practical Shop Problems

***Questions of a Practical Nature will be answered in these columns***

## The Proper Grinding Wheel

*Q. Are there any principles which we can apply in choosing the correct grinding wheel for use in sharpening cutters of varying classes and varying grades of steel?*

A. In general, the hardness of the wheel should be in inverse ratio to the breadth of contact. Cooler cutting action will result with a soft wheel on a wide cutting edge. The same holds true for varying hardness of steel.

A wheel which is satisfactory for harder steels will usually operate satisfactorily on softer steels, but it may not be the most economical one to use for the latter.

A softer wheel is usually required for high-speed than is the best for carbon-steel tools.

A coarse wheel can be made to take deeper cuts than are possible with a fine one, but the finish will be rougher. This finish can be improved on by dressing the wheel face before grinding.

In general, it is better to employ soft rather than hard wheels, and base economy on the use of two wheels of varying hardness if the work to be done is so divided as to warrant the additional expense. If two wheels are used, we advise posting instructions at the wheel stands as to which one is correct for each class of work.

This information is taken from mechanical data supplied the trade by one of the grinding-wheel manufacturers.

## Effect of the Acetylene Cutting Torch on High-Carbon Steel

*Q. Does the use of an acetylene torch for cutting high-carbon steel alter the steel structure?*

A. There is a change in structure at the surface, excessively large crystals resulting from the intense local heat. This change diminishes rapidly and is not apparent at approximately $\frac{1}{16}$ in. in from the surfaces as determined by tests in actual practice with micro photographs taken at various distances into the body of a locomotive connecting rod.

A description of the tests, which were made by Arthur F. Pitkin for the American Locomotive Co., was published in Vol. 55, pages 964 and 965, of the *American Machinist*.

## Thermit for Welding Cast Iron

*Q. Is there any difference between the thermit for welding cast iron and that which is correct for use with steel and wrought iron? Are cast-iron welds difficult to machine?*

A. There is a difference. That used for cast-iron welds is known as cast-iron thermit. It consists of plain thermit, mixed 3 per cent ferro-silicon 50/50, and 20 per cent mild steel punchings; or for each 100 lb. of plain thermit is added 3 lb. of ferro-silicon and 20 lb. of punchings.

Cast-iron welds are more difficult to machine than those of steel or wrought iron, because the cast iron, which contains over 3 per cent of carbon, fuses with the thermit steel, resulting in a high-carbon steel at the weld. This steel has ample strength and is less brittle than the original cast iron, but is also harder, so that grinding is generally resorted to when finishing is necessary.

## Force of a Blow

*Q. In driving a key with an 8-lb. sledge, what is the force of the blow exerted on the head of the key?*

A. The force of the blow, measured in pounds, is dependent on the amount the key was moved, or, if it did not move, on the amount the head was compressed.

Neglecting the latter condition, the force can be calculated when the speed of the hammer and the amount the key moved are known, in addition to the weight of the former.

Assume the key to have moved $\frac{1}{16}$ in. and the hammer to have been traveling at 30 ft. per sec. at the point of striking.

The kinetic energy in the hammer was then $\frac{W \times V^2}{2g}$ or $\frac{8 \times 30^2}{64.4}$ or approximately 112 ft. pounds.

This energy was then absorbed by the key in traveling $\frac{1}{16}$ in. and the force represented was $\frac{112}{\frac{1}{16 \times 12}}$ or 21,504 pounds.

## Sources for Employment

*Q. What are the sources to which an employment department can look to fill vacancies in the factory departments?*

A. The principal sources may be listed as follows:

Present employees.
Their friends.
Previous employees.
Voluntary applications.
Advertising in various ways.
Schools.
Employment agencies.
Competitors.

The first source is by far the most fruitful and the best for permanent results in direct proportion to the manner in which it is cultivated.

To use the last one is a dangerous and unethical practice, unless all operations are carried on in a fair "do-unto-others" attitude.

Punch here to suit your binder

# Characteristics of Duralumin

DURALUMIN is an aluminum alloy that has the advantage of being approximately one-third the weight of steel, or 0.101-0.103 lb. per cu.in. It can be supplied in various types and sections ranging from plates and sheets to angles and tubes, and can be cast, forged or stamped so that it may be used for a variety of parts. Duralumin is the trade name of the product and similar metals are made under other names carrying the same characteristics.

## Composition

The composition of the finished alloy can be stated as follows:

| | |
|---|---|
| Copper | 3.5-4.0 per cent |
| Manganese | 0.5-0.75 per cent |
| Magnesium | 0.5-1.00 per cent |
| Silicon | Under 0.60 per cent |
| Iron | Under 0.60 per cent |
| Aluminum | Balance |

Silicon and iron are generally impurities. The form in which the raw material is used is important and can be stated as follows:

Ingot aluminum over 99 per cent purity

| | |
|---|---|
| Copper aluminum alloy | 50 per cent copper<br>50 per cent aluminum |
| Aluminum magnesium | Aluminum 90 per cent<br>Magnesium 10 per cent |
| Aluminum manganese | Aluminum 90 per cent<br>Manganese 10 per cent |

## Casting and Rolling

Ingots or billets are generally cast 44 lb. in weight and of square section about 4 to 5 in. about 2-ft. long. These are standard billets, larger ones being cast as necessary. The order in which the constituents are added is as follows: Ingot aluminum, copper aluminum and aluminum manganese. These are melted and the aluminum magnesium added when a temperature of 800 deg. C has been reached. Casting is done at a minimum temperature of 690 deg. C. and a maximum temperature of 710 deg. C. Ingots can be rolled as cast and preheating is not necessary. For hot rolling the temperature should be between 480 and 500 deg. C. The first pass should be light with only about 5 per cent reduction. Hot rolling should be done at 180 ft. per min. and cold rolling at 90 to 120 ft. per min. The chill should be taken off the rolls for hot rolling.

## Annealing

As in first-grade steels, temperatures to which duralumin is subjected must be carefully watched and checked by the use of accurate pyrometers. The secret of good duralumin lies entirely with the accurate temperatures used in alloying and in heat treatments. Annealing should be done between the temperatures of 350 and 380 deg. C. and cooled in air. At this temperature the metal becomes plastic and can be worked and formed into various shapes. The purpose of annealing is to increase the softness and ductility, so that it may be more easily formed into various shapes, such as stampings, also that it may withstand the strains to which it is to be subjected.

## Heat Treatment

The tempering of duralumin consists of immersing the metal parts in a salts bath, heated to a temperature of 480 to 500 deg. C., then quenching in boiling water. The salts employed are potassium nitrate and sodium nitrate in equal parts. An important point is the period of time necessary for the material to remain in the bath. For annealing plates from 0.04 to 0.08 in. thick, 10 to 20 min. at 350 deg. C. is required and for tempering the time is from 7 to 16 min. at 500 deg. C. The following rough formula for the duration period for heat treatment may prove useful:

$$\text{Time in minutes} = C\sqrt{t}$$

where $t$ is the thickness of the plate in inches, and $C$ a constant (equal to 80 for an annealing heat and 60 for a quenching heat). The constant $C$ is slightly excessive and can be taken as a maximum. As an example, take two plates 0.016 and 0.070 in. in thickness:

| $t$ | $\sqrt{t}$ |
|---|---|
| 0.016 | 0.1265 |
| 0.070 | 0.2828 |
| Time for Quenching in Min. $60\sqrt{t}$ | Time for Annealing in Min. $80\sqrt{t}$ |
| 7.59 | 10.12 |
| 16.96 | 22.62 |

The heating chamber usually adopted for the treatment of duralumin is in reality a bath. It can be constructed of cast-iron or of mild-steel plates, welded or riveted. Built around the bath is a brick furnace, the requisites of which are as follows: (1) the temperature shall be uniform in all parts; (2) the metal parts shall be heated uniformly on all sides; (3) the temperature shall be readily controlled by the operator and (4) the temperature shall be indicated by a pyrometer. The methods of heating are electrical, gas or oil. Charcoal or coke should never be used, because the gases given off, if they should combine with the nitrates used in the bath, would result in a highly combustible and explosive compound.

## Machining

Duralumin can be turned and machined at practically the same speed and feed as brass. It does not seize or drag the tools, as do some aluminum alloys. Kerosene forms a good tool lubricant in threading or finishing parts, leaving a clean-cut surface. A mixture of lard oil and kerosene, in equal parts, will be found useful for average work. When buffed, duralumin takes a fine polish similar to silver, except that the surface lasts longer as it does not tarnish in the presence of sulphureted hydrogen and similar gases.

Punch here to suit your binder

Trim Line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# Technical Abstracts

### Advertising Machinery Abroad

E. W. Clark, advertising manager of the Sullivan Machinery Co. of Chicago, states that anyone who has tried to do business in Europe in the last seven years will agree that the success of our products and sales organizations abroad will be greater as the "Made in America" label becomes more subordinated. Competent local representatives can handle publicity campaigns far more effectively than can be done from the home office. In the Sullivan Machinery Co. the responsibility for selection of foreign advertising media and for writing the copy falls squarely on the local people.

Foreign branch offices furnish to the home office a report and budget. This report shows what they have been doing and the reasons for their future plans. An appropriation will be approved at home, depending upon the market conditions and the volume of business. The opinion of the local agent is always followed in selecting advertising media. The copy is usually prepared abroad, and the American address is rarely given. One point that is brought out is the wide variance in technical phrases, style and usage even in English-speaking countries.

In Great Britain trade paper copy is prepared in London and all reading matter is handled from that point. British technical journalism is of a high standard and Britishers away from home are greatly dependent upon their home engineering papers. Often the colonial firm is very intimately connected with London.

Advertising in France is controlled entirely by one of the American staff on the field with the aid of the local agency in the selection of papers. All copy is prepared and scheduled by them for appearance in the technical journals. Illustrations of machines in operation are always chosen, if possible, to represent equipment in French and European plants.

Australia has its independent technical journals and advertising media. There are several worthwhile mining, engineering and industrial papers which are extensively read throughout the Commonwealth and in which it pays to advertise.

In India there is one excellent engineering journal, published in Calcutta. Advertising in this paper is placed direct from the home office but proofs are submitted to the local representative.

In China, the foreign element read American technical papers or those published in London or Paris. The native Chinese can be best reached through their influential daily papers.

American technical publications are well represented in Japan, since their engineers read and speak English. All advertising, therefore, is placed directly by the Japanese agent in only those publications printed in the Japanese language.

In South America there are few technical journals of great merit. Some local newspapers are influential but most of the reading matter comes from America.—*Advertising and Selling Fortnightly*, May 6, p. 66.

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### The Herbert Hardness Pendulum

*Le Génie Civil* reviews three papers on the use and applicability of the Herbert hardness pendulum. One of these papers is by R. Mouillac, one by L. Guillet and J. Galibourg, and one by P. Nicolau. All are published in the April number of the *Revue de Metallurgie*. The authors explain the various ways to use the pendulum and the precautions to be taken. In general they find the method especially suitable for the investigation of very hard materials, where the Brinell is no longer suitable. The pendulum can also be used for samples too thin for the Brinell test. There is a relation between the Brinell hardness and the time occupied by 10 oscillations of the Herbert pendulum. Below 330 Brinell, the relation is: Brinell hardness $= 0.3 \times (\text{time of 10 oscillations})^3$. For hard steel the Brinell hardness is simply 10 times the time in seconds for 10 oscillations. A modification of the Herbert pendulum is shown for use in testing pieces of large dimensions. It is interesting to measure the effect of the working of cold by means of successive oscillations of the pendulum.—*Le Génie Civil*, June 6, p. 560.

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### Waste Elimination

Ray M. Hudson, of the U. S. Department of Commerce, states that the question of relative cost of effort involved in eliminating waste governs the application of corrective measures. From a theoretical point of view, a waste may warrant any effort tending toward its elimination, but practically, the effort may prove too expensive. This suggests the need for a continuing evaluation of existing wastes as against the probable cost of their elimination so the necessary corrective action may be taken at the proper time that will make it profitable.

It is difficult for executives under pressure of the day's events to give the careful attention necessary for the economical elimination of waste, so it is advisable to delegate to someone qualified for the work, the duty of constantly analyzing present wastes, determining their volume, and developing the best solution for their elimination.

Incidents are given of large savings that were effected in reducing or eliminating waste and attention is drawn to the fact that conservation of material naturally follows, an obligation which present generations must not overlook toward future generations.

Our fire loss amounts to $500,000,000 annually and is eight times as great per capita as in Europe. Our total loss from causes of waste is so staggering in its immensity that it is difficult to grasp thoroughly, but it must be taken care of. Over 50 per cent of the responsibility for waste in industry lies with management according to a survey of waste in industry. We may, therefore, confidently expect to see waste elimination more widely recognized as a fundamental of business management.—*Management and Administration*, May, p. 413.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

## *On An Even Keel*

THE best summer business in five years is bringing encouragement to the machinery industry. Actual figures for July cannot be tabulated and published for some days but the figures for June indicate a steady upward trend and informal opinion places the July business at least on a par with that of June.

Employment figures show sound conditions almost everywhere and the usual barometric indicators of general business, with few exceptions, read "Set Fair."

What is more, there is nothing to suggest that business during the rest of the year will do anything but ride along on an even keel. With such a prospect ahead of them the users of machinery can take a new grip on their confidence and go ahead with plans for the replacement of worn and obsolete equipment, and even the addition of new facilities where they are needed.

It will be good business to anticipate orders as much as possible because many equipment builders have only limited stocks and will find overnight orders hard to fill. Hand-to-mouth buying of commodities that are akin to raw material may be good business in this day of excellent transportation service but the same practice cannot safely be applied to machines that take months to build.

## *Machine Equipment in Trade School Shops*

ANYONE who visits the machine shops of schools or colleges cannot fail to be impressed with the number of machines that should have gone to the cupola years ago. It is of course possible to teach the principles of shop work on antiquated machine tools. General ideas of lathe, planer and milling work can be shown with machines that are hopelessly out of date, but the student whose experience is confined to these machines will be under a heavy handicap in any modern shop.

It may be advisable to keep a few old machines in the school shop by which to show the improvements of later development. It may even be a good thing to teach a boy how to do passable work on a machine that is not in first class condition, to enable him to tackle any sort of a shop he may find. But he should also be familiar with the latest developments in machine tools if he is to reflect credit on the practical teachings of his alma mater.

Although most colleges are not over burdened with funds for equipment, the question of keeping the machine shops up to date should not be overlooked. Bequests from engineers might well specify that this department shall receive at least part of their money. For no school shop with antiquated equipment can give the students a proper knowledge of machine shop practice.

## *Using Belts with Motor Drives*

THE use of individual motor drives on machines of all kinds does not necessarily eliminate the use of belting as many seem to think. Those who think they see the elimination of leather belts as a result are likely to find themselves sadly mistaken. Many users of machines, as well as the makers, insist on a leather belt between the motor as a cushion and as a safety valve. Some use a chain for this link in the drive, but in many cases a chain takes the place of a gear train rather than of a leather belt.

In either case the use of belting will continue for many years to come as it has a distinct field in many lines of power transmission, even where individual motors are used.

## *Simplifying Design Saves Cost of Spare Parts*

THE Curtiss Aeroplane & Motor Co. is to be congratulated on the simplification of design of its new plane, the "Lark," in which all the control surfaces are interchangeable. Instead of having seven different control surfaces as spare parts in the hangar, but one is now needed. Wing, interplane and landing gear struts are also interchangeable.

The design looks a bit unusual but the efficiency is practically unimpaired and the cost of manufacture is greatly reduced. Simplification is the order of the day but it is unusual to see it applied to such a new industry and shows that the practical problems concerning the commercial use of the airplane are being carefully considered.

## *Just Suppose*

JUST suppose that you are trying to sell a good machine to a hard-boiled purchasing agent. You know your price is right and you are almost certain your bid is the lowest one. And yet he says that your competitor's price is lower, or that he can beat your delivery date forty ways, or that he will give absurdly easy terms.

You know very well he is lying and yet it makes you uncomfortable on the off chance that there may be a grain of truth in what he says.

Wouldn't it be cheerful if no buyers indulged in such unethical practices?

Just suppose.

# Shop Equipment News

## New Britain Automatic Chucking Machine No. 12A

A chucking machine known as No. 12A is being built in addition to its other lines by the New Britain Machine Co., New Britain, Conn., for chucking work and for second-operation screw-machine work on brass, malleable, cast-iron and forged parts within its range. It has been designed primarily to take advantage of the high cutting speeds made possible by the use of modern tool steels, to cut idle time between operations to a minimum and to relieve the operator of work that can be handled by power. The machine has a turning capacity of work 2 in. in diameter, will thread up to 1 in. and will swing a maximum of 5½ in. outside the chuck jaws. The stroke of the spindles including the jump can vary between 1 and 2½ inches.

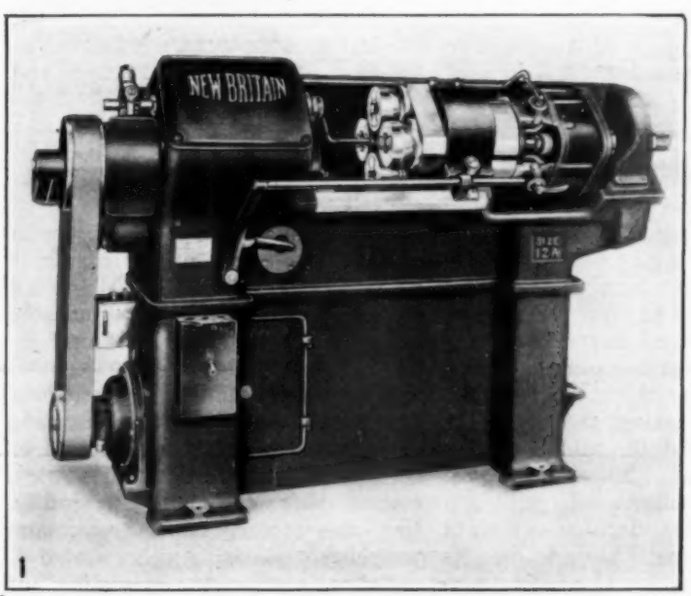
There are three spindles and four work chucks, loading and unloading being done while the cutting tools are in operation. All operations with the exception of placing the work and operating a control to close the chuck jaws by power are accomplished automatically by the machine.

Spindles Nos. 1 and 2 are arranged for drilling, boring and turning and are independently driven by change gears from an intermediate shaft. These gears are mounted in separate sets for each spindle at opposite ends of the headstock. They are protected by removable guards. Spindle No. 3 is intended for tapping but can also be used for the same purpose as the other two. It has included in its assembly a reversing mechanism which consists of two bronze friction cones actuated from the feed-cam shaft that engage inside of the spindle driving gears. These gears, one for forward and one for reverse rotation, receive power respectively from the independent drives of the other two spindles and revolve in direct ratio, approximately one half, to them. Nos. 1 and 2 spindles have a range of speed in 12 steps between 366 and 2,065 revolutions per minute.

The spindle bearings are provided with adjustable phosphor-bronze bushings tapered on the outside. The spindle themselves are of chrome-vanadium steel, heat-treated, hardened and ground. All have integral noses, Nos. 1 and 2 being arranged for boring and turning tools and the third to receive a clutch type tap or die holder or other tools. Nos. 1 and 2 measure 1⅞ in. in the bearings while No. 3 measures 1⅛ inches.

The work-turret and the 4-cylinder block for actuating the chucks by air together with the Geneva index plate, illustrated in Fig. 3, are mounted on a common shaft as a complete assembly. The turret rests in a main bearing 9 in. in diameter by 6 in. wide which is accurately scraped to fit. The cap on this bearing is arranged to clamp during work periods and to release for indexing. The outer end of the turret shaft rides in a solid bronze bushing held in a split box in the end of the frame to provide for removal of the unit, without taking it apart. There is no longitudinal movement of the turret during operation but it may be adjusted and accurately positioned within a range of 4 in., when being set up, by means of a graduated nut and locknut located on the end bearing.

Air at 80 lb. to the chuck cylinders is taken through the front center of the turret from a connection at the back of the machine frame which is arranged to compensate for the longitudinal adjustment and to clear the work as the latter is indexed. The exhaust air is passed back



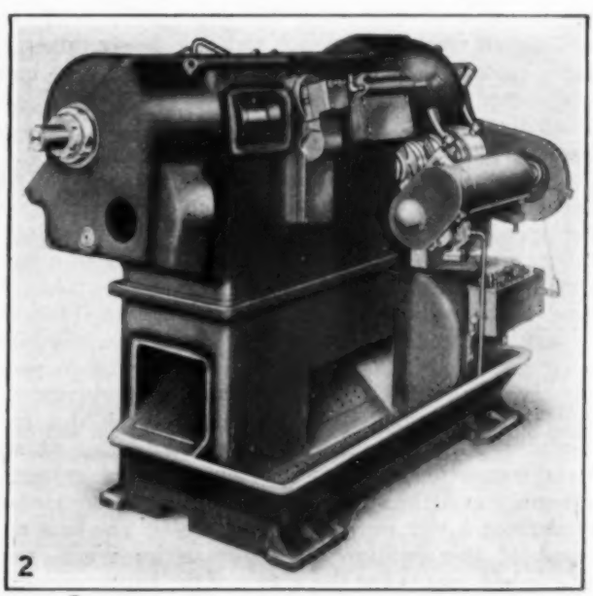




*Fig. 1—New Britain Automatic Chucking Machine No. 12A. Fig. 2—A rear view of the machine.*

# SHOP EQUIPMENT NEWS

through the chucks to assist in cleaning the chuck jaws of any chips. The valves to operate the chucks are arranged with handles located between the cylinder block and the turret. As the turret is indexed a hook rod secured to the frame engages the valve controlling the finished-work chuck and releases the pressure so, by the time that indexing stops, the work has been ejected, the jaws are cleaned and ready for the next piece. The operator places this piece and moves the valve lever to the gripping position.

The turret-locking bolt is rectangular in section and rides in an adjustable gib which is provided to compensate for wear. Both bolt and gib are hardened, ground and lapped, and are assembled in a housing secured to the back of the frame. The bolt springs are also included in this housing. Spring pressure and gib adjustment can be taken care of by screws and locks projecting from the back of the housing.

The turret-locking bolt is rectan- mounting of 2- or 3-jaw, air-operated collet chucks, 2-jaw, screw-type chucks or eccentric, draw-back, threaded arbors. All are made by the company and furnished with the machine to specification. The collet chucks have a work capacity of 1¾ in. and are 5½ in. in diameter. The 2-jaw chucks are 6 in. in length. Special work-holding fixtures, either air or hand operated can also be furnished.

A shaft extending the length of the machine carries cams for controlling all work movements and receives power through a steel worm and bronze worm wheel from a drive assembly secured back of the head stock. This assembly is in turn driven by silent chain from the main drive shaft, and contains provision for speed change gears to give 13 rates of feed, and an automatic, clutch-controlled fast drive which is used to decrease the time consumed in turning the camshaft through idle positions. A ratchet escapement on the slow-speed drive allows this fast motion to be engaged without interference. Another clutch which controls connection between the drive assembly and the camshaft is operated from a rod running across the front of the machine and offers a convenient means for the operator to engage or disengage the machine movements. The wormshaft is also extended through to the front of the machine and terminates inside of a protecting pocket in a squared end. A hand-crank is provided for use at this point to turn the camshaft by hand for assistance in setting up. An interlock is arranged between this lever and the power-drive control so that the latter covers the end

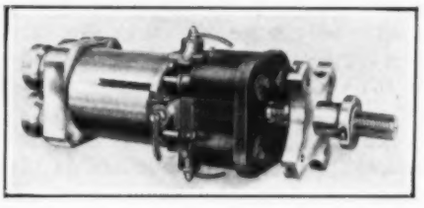


*Fig. 3—The work-turret assembly*

of the hand-shaft and prevents the hand-crank from being placed, or if the crank is in position prevents the power drive from being engaged. The arrangement is illustrated in Fig. 1, the front view.

There are five independent cams mounted on a camdrum below the headstock. The first, an adjustable, laminated cam, controls the positive lead of the threading spindle through a lever at the end of the machine. Nos. 2 and 4 cams, of the plate type, actuate the other two spindles and may be replaced to suit varying classes of work. Between these two, a dog-type cam actuates the clutches for direction of rotation of the threading spindle. The fifth cam, also of the dog-type, controls the high-speed camshaft clutch previously described. Both dog-type cams may be moved and set to best suit conditions.

Two solid cams, mounted on the shaft below the turret are set to release the clamping of the turret-bearing cap and to withdraw the turret-locking bolt. The shaft terminates in a bearing at the end of the frame. At this bearing elliptical gears are located to drive the Geneva index, the elliptical shape being designed to yet further eliminate lost time in indexing the turret without shock, by increasing the speed of rotation at about the middle of the index movement. These gears are of heat-treated alloy steel.

The base of the machine is a rigid one-piece casting, planed on its entire upper surface to provide support for the frame. It is cored out at the bottom to form a reservoir for the coolant. The coolant pump is located and driven from below the camshaft drive. There are also two openings arranged, one at the back for chips and one at the end for finished parts as shown in Fig. 2. Baffle plates deflect the work from the chips and direct each in the proper direction. A space is provided for the driving motor inside the base at the headstock end where it is amply protected and arranged to drive the machine by belt. The control is set at the front convenient to the operator. A motor of 1,800 r.p.m. and 3 hp. to drive the 10x2 in. machine pulley at 870 r.p.m. is recommended. Belt drive from a countershaft may be obtained if desired, in place of the motor.

A compartment is also arranged at the front for the extra change gears, the gears being mounted in sets on spindles on the inside of the door.

The machine frame carrying all of the bearings is also a heavily-constructed one-piece casting. It is designed to have a bearing on the base for its entire length and to bring the spindles forward to the best position for watching the operations and for placing the work. The overhang to the front illustrated in Fig. 2 makes it convenient for the operator to work while sitting down without interference with the base.

Lubrication of all the moving parts has been featured as an essential in connection with the high speeds and continuous operation for which the machine is designed. A lubricator is mounted at the rear of the base and is driven from the end of the cam-drive shaft. This lubricator provides oil at each bearing under pressure and in an adjustable, measured amount which is correct for each independent bearing.

Production will be in step with the rotating speed of the camshaft or between 177 and 2,370 finished pieces per hour. The machine occupies a floor space of 35x84 in. and weighs 3,700 lb. net.

Standard equipment consists of four 2- or 3-jaw collet chucks, six pairs of speed gears, four pairs of feed gears, force-feed lubricator, countershaft or motor mounting, less the motor, hand crank and wrenches.

Extra equipment consisting of 2-jaw chucks with draw racks and

# SHOP EQUIPMENT NEWS

pinions, special speed and feed gears, coolant pump and piping and clutch-type tap or die holder are available as ordered.

Another machine, known as the 23A, following the general design of the 12A, and including all of its meritorious features is about ready for the market. The 23A will be of the four-spindle type with five air-chucking positions, and will handle work up to 7 in. in diameter.

## Bench Combination Shear Rod-Cutter and Punch, No. 3

The Bench Machine Tool Co., 220 North 13th St., Philadelphia, Pa., has has added the combination tool to its line of hand-operated equipment. It is intended for use as a general-utility tool in the machine shop and in the sheet-metal shop. It may also be applied in the foundry for cutting core rods.

The punch and the shear are mounted in front of the rod cutter, which latter is essentially of the same design that was previously described on page 712, Vol. 62 of the *American Machinist*.

*Bench Combination Shear, Rod-Cutter and Punch, No. 3*

The unit has a capacity up to ⅛-by 2½-in. flats, ½-in. squares or rounds, and punches up to ¾-in. holes in ⅝-in. steel plate. The throat of the punch is 2 in. in depth. It can be mounted on a low bench, or a stand or truck can be furnished when specified.

## Landis Roll-Grinding Machine, 50-Inch

The Landis Tool Co., Waynesboro, Pa., has completed construction for the Mesta Machine Co. of West Homestead, Pa., of the roll-grinding machine illustrated. It is believed to be the largest grinder ever built for commercial use and is to be used for grinding chilled iron and steel rolls weighing as much as 56,000 lb. and steam engine pistons that measure 16 in. in diameter by 22 ft. in length. The machine will swing a maximum over its bed of 52 in. and will take 24 ft. between its centers. Exclusive of the electrical equipment, it has a total net weight of 110,000 pounds.

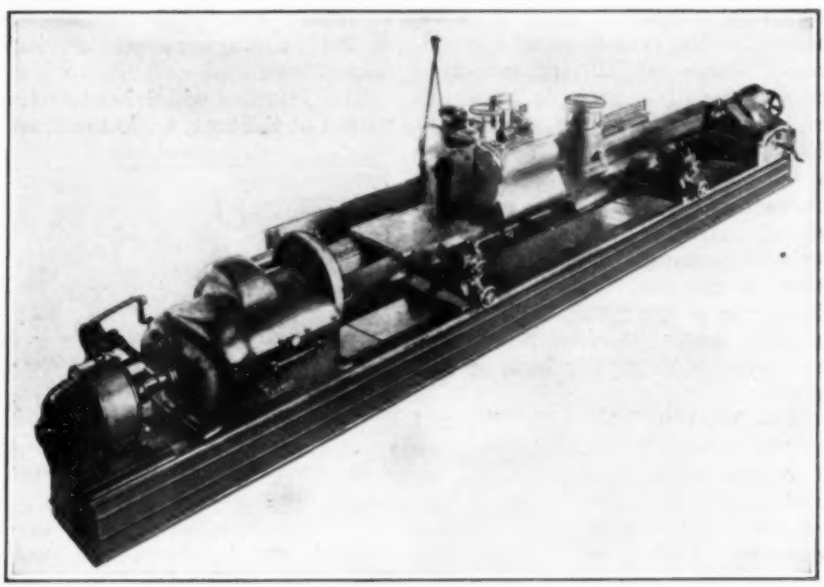


*Fig. 1—Landis Roll-Grinding Machine, 50-Inch*

The bed, which is made in four sections, dividing lengthwise at the water channel and across at about the center of the machine, is designed with two sets of ways. The front set is a combination of inverted V- and flat-ways for carrying and guiding the work supports, while the rear sets are standard V-type design and provide a guide and support for the grinder assembly. Flat plates of heavy-gage steel are included to protect the ways while the machine is in service. The bed also has a large water channel located between the two sets of ways which has a capacity for holding 300 gal. This makes a total water-holding capacity of 1,200 gal. with the main tank which is constructed in various compartments in the machine foundation. A water pump driven by a 5-hp. motor forces water through the delivery lines to the wheel.

The headstock, which weighs approximately 12,000 lb., is clamped in a fixed position and contains steel herringbone gears of the Sykes type which are connected by a flexible coupling to a 25-hp., adjustable-speed motor that is mounted on a base-plate at the end of the bed for rotating the work only.

Back gears are controlled through a tooth clutch and are operated by a lever on the front of the headstock to utilize the speed range of the motor in two steps. This gives a continuous range of speeds between 4½ and 72 r.p.m. Fig. 2 illustrates the arrangement.

The spindle measures 8 in. in diameter and is made of chrome nickel steel. It is supported in bearings which measure 23 in. and 16 in. in length at the front and rear of the headstock respectively. Lubrication is supplied to all of the bearings under pressure from a plunger pump that is driven from the first drive shaft. The bottom of the headstock forms a reservoir for the oil and is equipped with a settling compartment and a strainer ahead of the pump. The gears run in oil.

The footstock is moved on its ways by turning a crank connecting through a worm, wormwheel and

# SHOP EQUIPMENT NEWS

rack pinion to a rack on the machine bed. The leverage afforded is sufficient to move the 6,000 lb. in this assembly without undue effort. Clamps are provided to secure it in the desired position. The footstock spindle measures 7 in. in diameter and is adjusted lengthwise by operating a handwheel. It can also be clamped in position.

The grinding wheel assembly, which is a complete unit in itself, travels on the rear ways of the bed, the distance of 30 in. measured across them being ample to secure rigid alignment. It is illustrated in Fig. 3. The 30-hp., adjustable-speed motor which drives the wheel through a 10-in. belt, rides on a separate platform attached to the grinder housing. This platform in turn is mounted on wheels which travel on a flat track back of the grinder ways. Current is supplied by trolley lines strung back of this track.

The head weighs 9,000 lb. and carries a wheel spindle in two cap bearings which measure 4½x15 in. and 3½x12 in. respectively. The spindle is made of alloy steel, hardened and ground, and is provided with a hole longitudinally through its center for the circulation of cooling air.

The wheel head is moved on its

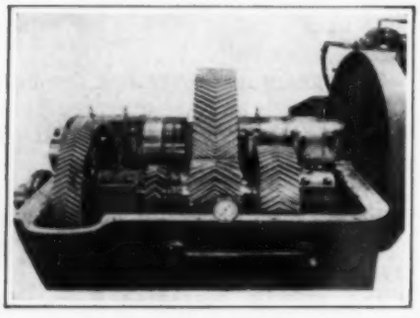


*Fig. 2—The headstock with the cover removed*

cross ways, to and from the work, by operating a handwheel which is provided with a dial graduated in thousandths in terms of the diameter of the work. Rapid power movement of 2 ft. per minute is also available in either direction through a 2-hp. motor operated by a drum controller. This controller, together with push-button control for the work drive motor and grinding-wheel drive motor, are also located together on the operator's platform on the grinder carriage.

Automatic forced-feed lubrication is built into the grinder head and is checked in its operating through glass-covered compartments properly located. The bearing surfaces of the bed and carriage are lubricated from reservoirs fitted with rollers and located at intervals in the V-ways. Both the bedways and the bearing surfaces under the carriage are chilled throughout their entire length.

The grinding-wheel head is trunnioned at the rear, while the front is

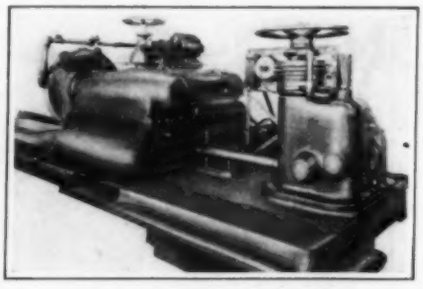


*Fig. 3—The operator's position on the grinding-wheel head*

carried on hardened-steel rollers which rest on hardened cams. The latter are generated to a shape that produces a constant drive to the grinding-wheel head when they are rotated through change gears provided for the purpose. Various combinations of these gears may be selected with the help of a graphic chart that is provided with the machine and will produce various amounts of crown or concavity to the work.

This vertical movement of the wheelhead is combined with the traversing movement of the carriage to make it possible to produce correct curvature regardless of the amount of crown or concavity.

Two heads, designed to support the weight of the rolls which are being ground, are set on the main bed of the machine. They are of the two-bearing type and are made adjustable to accommodate varying work sizes.

A straight, ground bar is mounted on the front of the machine parallel to the travel of the grinding wheel. This bar carries an indicator which permits the operator to check the work for parallelism or the amount of camber.

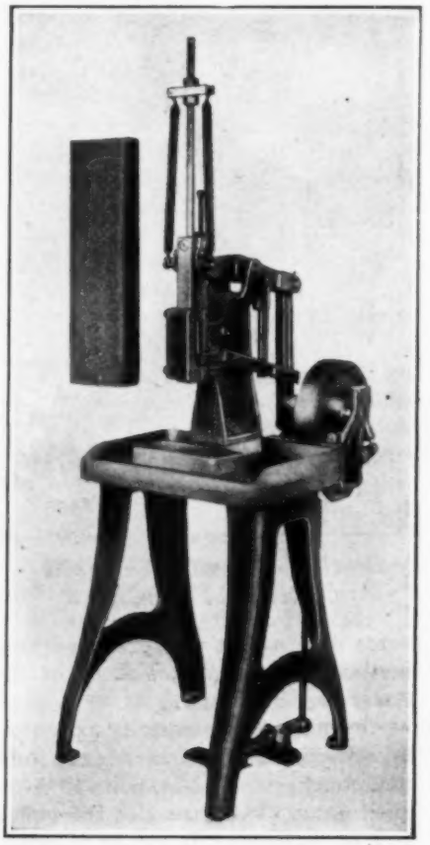
## Taylor & Fenn Power-Operated Spring Press No. 12

The Taylor & Fenn Co., Hartford, Conn., has added the No. 12 power operated press to its line of foot-operated spring presses previously described on p. 557, Vol. 62 of the *American Machinist*. Aside from the power features, the machine embodies the same principle as the others, of striking a uniform, measured blow and is applicable for the same purposes as a drop hammer or ordinary power press on lighter classes of work.

The press illustrated is single acting, but can be furnished in the double-acting design if so ordered.

The power-operating arrangement is mounted at the rear and consists of a flywheel-pulley and trip mechanism designed to ordinarily stop after each revolution, independent of the position of the trip pedal. It may, however, be set to repeat by a minor adjustment.

The stroke is 3½ in. The maximum distance from the bed to ram



*Taylor & Fenn Power-Operated Spring Press, No. 12*

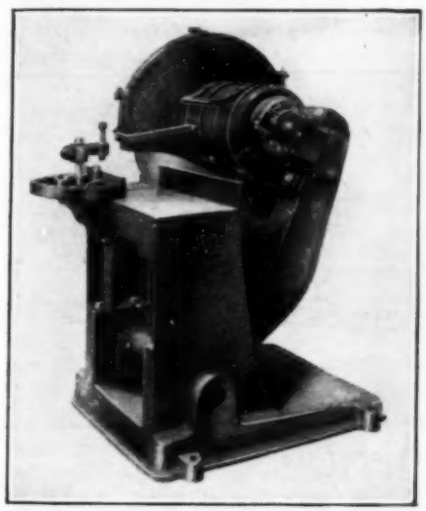
# SHOP EQUIPMENT NEWS

measures 7¼ in. The depth of stroke is 4 in. and the bed plate measures 12x5 in. The floor space required is 24x30 in. and the net weight is 550 lb. The speed of the 12x2-in. pulley is 60 r.p.m. Two 50-lb. springs are regularly furnished.

## Ryerson High-Speed Friction Saw, No. 0

The high-speed friction saw illustrated has been developed by Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Ill., for cutting structurals, pipe and rounds of the smaller sizes and in relatively small quantities.

The machine has a capacity for 8-in. by 25½-lb. I-beams, 8-in. channels, 4-in. pipe, 1½-in. rounds and 1¼-in. squares. It operates on the same principle as the larger friction saws built by the company and is said to give a true cut without distortion. Cuts of 1½-in. rounds and 8-in. by 25½-lb. I-beams are said to be easily made within 15 sec., and a little over a minute respectively.



*Ryerson High-Speed Friction Saw, No. 0*

The blades are ¼ in. in thickness by 24½ in. in diameter and are mounted direct on the spindle of the 10-hp. ball-bearing motor which is specially built for friction-saw duty. Feed into the work is by hand.

Water cooling for the blade can be furnished, depending on the size of the pieces to be cut, but on the smaller structurals, bars and shapes, the cutting can be done dry.

## Baker Single-Purpose, Double-Spindle Drilling and Boring Machine, No. 125

The single-purpose drilling and boring machine shown is manufactured by Baker Bros., Inc., Toledo, Ohio, essentially as a production machine. It is furnished only in the self-contained motor-drive, direct-gear type illustrated, and is intended for use on connecting rods, brackets and similar parts, on a plain table, or with a circular indexing table for consecutive operations, such as rough and finish boring or drilling and reaming. The spindles can also be adapted for driving multiple-drill heads and can be arranged with depth stops for facing to an accurately predetermined depth.

A 9½-in. center distance between the spindles is fixed, but can be altered within limits if desired. The capacity is limited to drilling with both spindles in steel up to 1¾ in., or the equivalent.

While one speed and one feed are regularly furnished for each machine, the crown gears on the spindles are readily removable and are arranged so that the speed of either spindle can be changed independently of the other. The ratio of the drive from the motor can also be readily changed to alter the speed of both spindles, and slip-change gears are provided for the feed train, which in combination with single-, double- or triple-lead wormgears provides a range of feeds with which it is possible to meet any requirements.

The spindles, which are of high-carbon steel, are fitted with special chrome-nickel thrust races. They are slotted across their ends for driving heavy boring and facing tools, fitted with a cross drift for holding heavy tools and, in addition, have hollow set screws to prevent light tools from dropping out. They are bored with a No. 4 Morse taper.

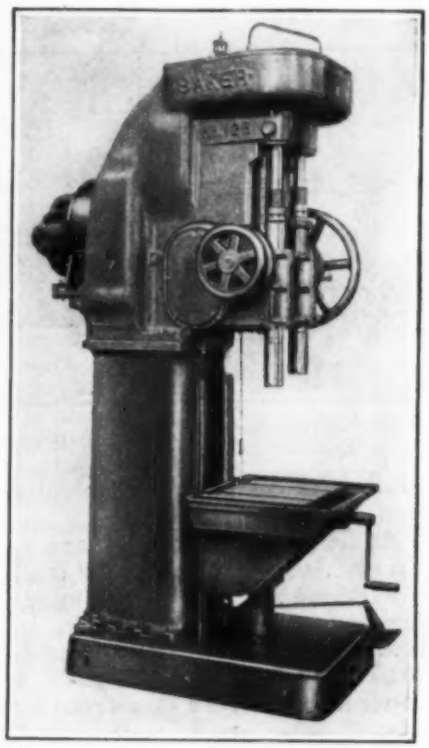
The Baker patented foot treadle is included in the design for engaging the feed in order to leave both hands of the operator free for chucking work. The feed is disengaged by means of an adjustable trip on the quill, the spindles returning to their upper position by counterweights. The other controls have been designed and arranged in order that one man may attend a number of machines set in line.

A pressure-lubricating system is used for the gearing and is provided with a glass indicator in front of the machine to show the rate of flow, and a gage with which to check the height of oil in the reservoir.

The machine is furnished with a plain table as regular equipment, but an indexing table or special fixtures can be suppled to specifications. The company is also prepared to design and build multiple heads for given requirements.

Oil pump, tank and piping are furnished as extra equipment.

The distance from the center of the spindle to the plain table is a regular maximum of 29 in., but when necessary this can be increased by using spacing blocks. The length of the spindle sleeve is 11 in. and its diameter 3 in. The least diameter of the spindle is 1¼ in. The table has a vertical adjustment of 18 in. The machine occupies a floor space of 25x36 in. and weighs 4,200 lb. with the 7½-hp. motor.




*Baker Single-Purpose, Double-Spindle Drilling and Boring Machine, No. 125*

# SHOP EQUIPMENT NEWS

## Pratt & Whitney Thread Miller, 10-Inch

The 10-inch thread miller being built by the Pratt & Whitney Co., 111 Broadway, New York, N. Y., is designed to replace the 12-in. model of the same machine previously put on the market by the company. The purpose of the change is to produce a more powerful machine and one that offers greater convenience in operation, and while the work principle has been retained, the design has been radically changed.

The machine is standard in two lengths, with 24-in. and 60-in. center distances respectively, but other lengths are available to order.

It is intended for use in making accurately-finished threads on precision screws, worms and lead screws, for milling keyways, annular grooves, spline shafts and similar work.

As illustrated in Figs. 1 and 2, the machine consists of a rigid base, a workhead for rotating and indexing at one end of the work, an accurate lead screw with provision for setting to a range of leads, a cutter head to drive a single rotating type of cutter, shaped to the thread form to be produced and a tailstock to carry the outer end of the work.

The 7½-hp., 1,740-r.p.m. motor to drive the machine is mounted, as illustrated in Fig. 3, on a hinged platform inside of the cabinet-type leg which supports the headstock end of the bed. Power is conveyed through a belt to a pulley, containing a friction clutch, on the constant-speed drive shaft which extends the length of the bed at the rear. Countershaft drive can be used in the place of the motor by belting to the same clutch pulley.

Power is taken from this drive shaft through separate, inclosed change-gear assemblies for the workhead and the lead screw, there being 17 work speeds between 0.04 and 0.635 r.p.m., and a range of leads from 12 threads per in. to 48 in. per revolution. Work indexing for multiple threads is provided for by the notched indexing ring mounted on the spindle. This ring is accessible from in front of the spindle bearing and is made solid, a departure in both particulars from the previous design.

A third gear box contains change gears for driving the cutter in five steps between 29.3 and 96.2 r.p.m., and also derives power from the constant-speed shaft at the rear. The gears are heat-treated and run in oil. The cutter drive, as well as the gears in the speed box, receive their supply of lubricant from a central system.

The cross slide on the cutter head

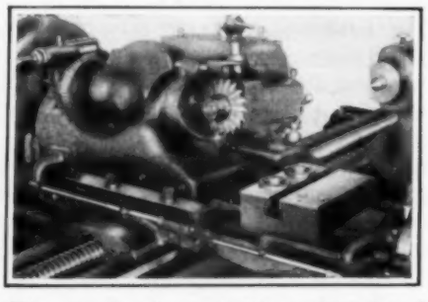


*Fig. 4—A view of the cutter head*

is provided with a positive stop for the cross-slide screw, designed to enable the operator to return the cutter to exact depth for milling recurring pieces of work after the cutter has been backed out at the end of a cut. The cross slide has sufficient travel to take work up to 10 in. in diameter with a 1⅝-in. depth of cut.

The tailstock has a double clamping arrangement to withstand the heavy cuts for which the machine is designed.

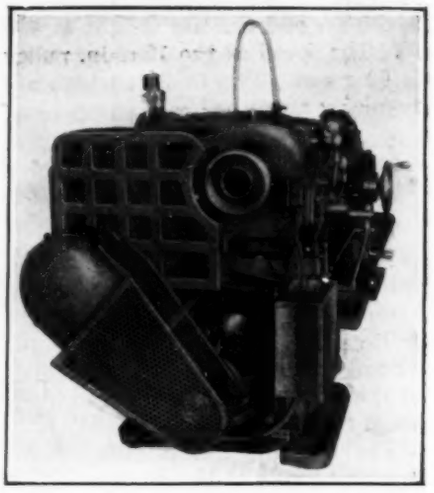
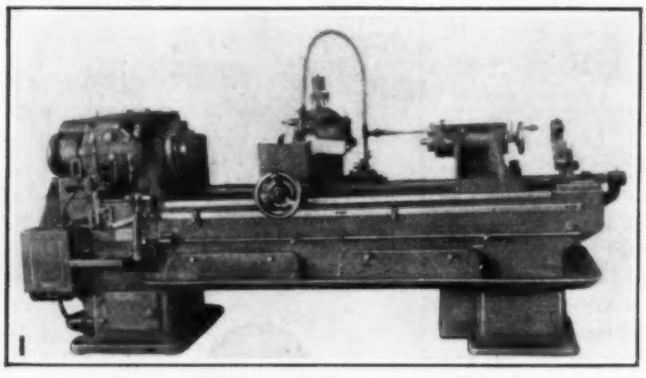


*Fig. 3—The motor mounting and protected drive*



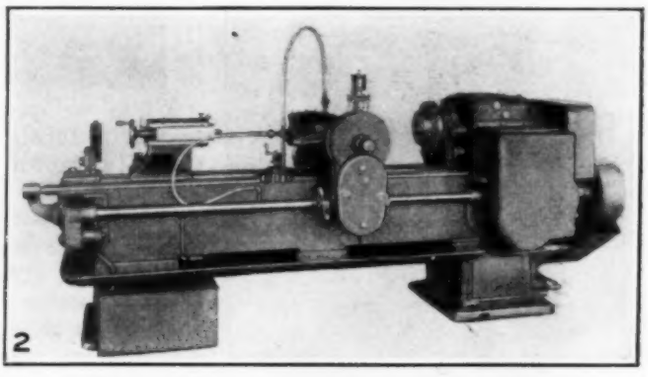



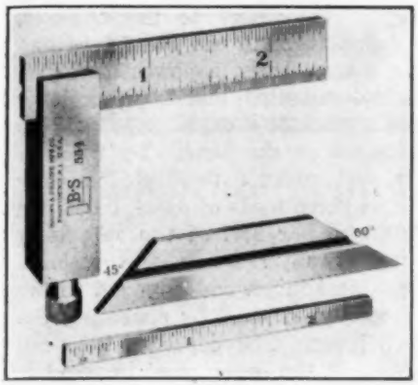

*Fig. 1—Pratt & Whitney Thread Miller, 10-Inch. Fig. 2—The rear of the machine*

## Brown & Sharpe Adjustable Square, No. 554

An adjustable square that includes three blades for certain purposes has been added by the Brown & Sharpe Manufacturing Co., Providence, R. I., to its line of small tools.

A wide blade with square ends can be used as a graduated try-square or depth gage, in "hard to reach" places. The bevel blade, which carries a 45-deg. angle on one end and a 60-deg. angle on the other, is intended for checking bevels on thread tools and for laying out angles and mitres. The narrow blade, which is ⅜ in. in width, is serv-

# SHOP EQUIPMENT NEWS



*Brown & Sharpe Adjustable Square, No. 554*

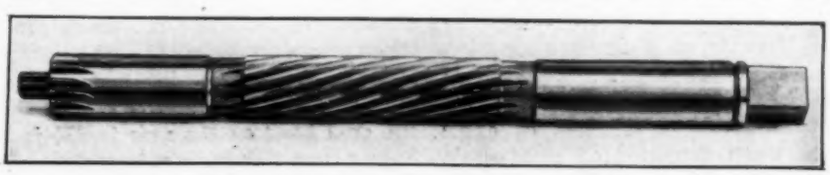
iceable in inaccessible places, for squaring small slots, measuring the depth of counterbores and small holes, and for similar work. A clamping device secures the blade in the body against a square shoulder.

The set may be purchased complete with all of the blades, or may be specified to exclude any of the three that are not desired.

## Modern "Red-Line" Expansion Piston-Pin Reamer

A feature of the "Red Line" expansion reamer, being produced by the Modern Reamer Specialty Co., Millersburg, Pa., lies in the increased number of flutes over that usual in such a tool. This increase is said to better the cutting properties and to assist in prolonging the life of the reamer. Another point of design having to do with the method of expansion is said to insure accurate movement of the cutting edges when they are adjusted.

The reamers are made in sizes ranging from ¼ to 3 in. in a number of steps. The number of flutes vary from 6 in the small size to 30 or more in the larger ones. They are sufficiently deep to allow for chip clearance. They are designed to cut from 0.001 to 0.003 in. of metal and are essentially intended for finishing work for piston pins and similar pieces.



*Modern "Red-Line" Expansion Piston-Pin Reamer*

## Victor Collapsible Reamers and Taps

The Victor collapsible reamers and taps illustrated in one size in Fig. 1, have been developed in the Victor plant of the Landis Machine Co., Waynesboro, Pa., for use in machining and tapping the seats of gate-valve bodies in which the thread diameter of the seat is usually larger than that of the pipe ends. The collapsible feature allows the tools to be inserted and then expanded to the correct diameter and used as shown in Fig. 2, which illustrates a work set-up.

The tools are in pairs, one being fitted with plain cutters for counterboring and reaming and the other with chasers for tapping the threads. The cutters are of the double form to permit of tapping both seats at the same setting and without reversing rotation. Proper clearance is provided on either end. An adjustment of approximately ⅛ in. is available, either over or undersize, to obtain the fit desired and to compensate for wear when the cutters

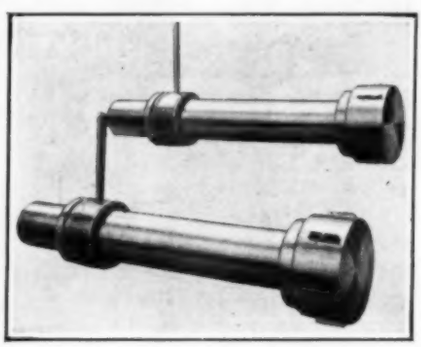


*Fig. 1—Victor Collapsible Reamers and Taps*

are ground. The patented construction is on the same principle as used in all Victor collapsible taps. The line ranges in capacity from 2 to 8 in. and can be used for machining bodies with angle as well as parallel seats by swiveling the valve properly in the holding fixture.

In operation, the reaming and counterboring tool is inserted and expanded by throwing the expanding lever, located on the shank. The seat on the far side of the valve is machined first and then, by drawing back the turret in which the tool is secured, the other seat is finished

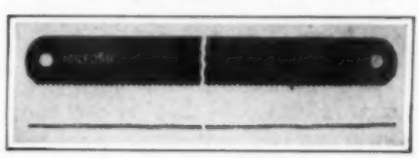
*Fig. 2—A work set-up*

without stopping the machine. The tool is then collapsed and withdrawn. The threading tool is used similarly, except that the chasers are collapsed when they reach the end of the first cut, withdrawn, reset and fed to the other cut.

## Thompson "Wavy-Set" Hacksaw Blades

The Henry G. Thompson & Son Co., New Haven, Conn., has introduced a method of setting the teeth of hacksaw blades that is intended to give additional strength to the teeth and to make the application of such blades more nearly universal. It is said, with this form of setting, that it is quite practicable to use a 10-pitch blade on thin-walled tubing.

The "wavy-set" is accomplished by passing the heated blades through a series of suitably shaped rollers that bend the serrated edge first in one direction and then the other, imparting to the edge a wavy appearance not unlike that of a thin circular milling cutter. The waving



*Thompson "Wave-Set" Hacksaw Blades*

extends away from the edge far enough so that each tooth is assured the support of the full thickness of the stock, and the abrupt bend caused by the usual method of setting is avoided. The wavy-set is applied to all hacksaw blades made by this company.

# SHOP EQUIPMENT NEWS

## American Maxi-Speed, Sensitive Ball-Bearing, Radial Drill

The American Tool Works Co., Cincinnati, Ohio, is building and has on the market a sensitive radial drill in three sizes, 3 ft., 3½ ft. and 4 ft., and with three types of drive, belted as illustrated in Fig. 1, and direct motor driven for use with a.c. and d.c. current, as shown in Figs. 2 and 3 respectively. On the a.c. drive, a constant-speed, squirrel-cage, 3-hp. motor is recommended, while on the d.c. drive the motor is of the variable-speed type.

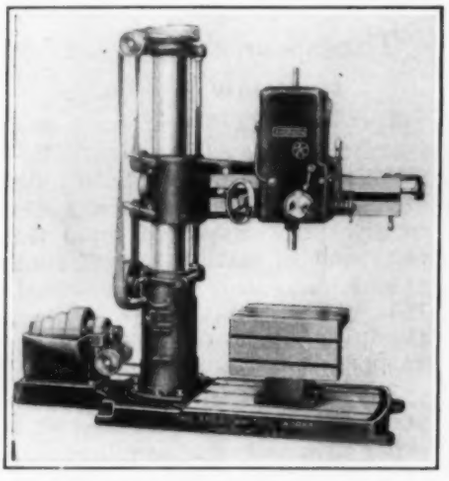
It has been developed for high-speed drilling, tapping and counterboring, in capacities up to 1 in. inclusive, on work such as engine frames, transmission cases, chassis work, switchboards and similar products.

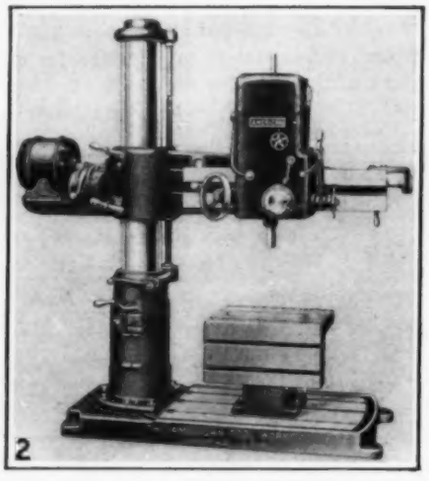
On the belt-drive machine, there are eight spindle speeds ranging between 400 and 2,000 r.p.m. On the a.c. drive, six speeds are provided in a gear box, set between the motor and the horizontal driving shaft, that vary between 500 and 2,000 r.p.m. The box contains a gear assembly of the tumbler type with gears of alloy steel, heat-treated and running in oil. A friction arrangement is actuated to disengage when the tumbler lever is raised to shift speeds and acts as a protection for the motor and drill against sudden shock. This gear box is omitted on the d.c. drive, and a variable-speed motor of the same horsepower with a compound faceplate rheostat are used as illustrated. The number of steps in the 500- to 2,000-r.p.m. spindle-speed range is dependent on the number of points on the rheostat. The motor in this case is connected to the drive shaft through a flexible coupling.

The radial arm is raised and lowered by means of a lever which is used to rotate an elevating screw. Clamps are provided for adequately locking at a given position. The arm is swung by hand while a handwheel at the left of the head moves the latter along the ways on the arm. The design is said to be such that very little exertion is required to move the units. The head is arranged with a ratchet-lever hand feed, located at the right side, which automatically disengages, when placed in a vertical position, to permit of quick spindle movement by use of the small handwheel located on the same shaft. On the left side of the head is a tapping-attachment lever by which the spindle is engaged, released or reversed. This lever operates multiple-disk clutches to drive the spindle in either direction. A brake is also actuated by this lever to stop further rotation when the lever is put in the neutral position. The purpose of the brake is to relieve the clutches of extra work when direction of rotation is reversed, and to assist in making the spindle responsive to the changes.

In addition to the hand feed and the control lever, a power-feed dial, a feed-engaging and tripping lever and a graduated depth gage are also mounted on the head. By rotating the dial under a fixed pointer, any one of three feeds of 0.003, 0.006 and 0.010 in. per rev. of the spindle is automatically set on the inclosed feed mechanism and engaged to the spindle or tripped by operating the feed lever. The depth of hole can be set on the depth gage to trip the power feed or to render the hand feed inoperative beyond a desired point. Ball bearings are used throughout the construction to conserve power and to bring the effort required to move the machine to changing set-ups to a minimum.

The design of base, column and adjustable arm construction is that which has been standardized on by the company in its other lines.



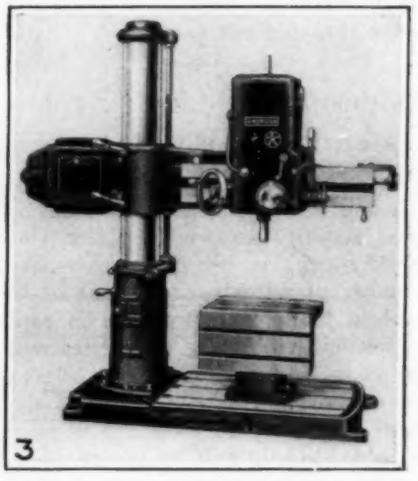




*Fig. 1—American Maxi-Speed, Sensitive, Ball-Bearing, Radial Drill. Fig. 2—The a.c.-drive design. Fig. 3—The d.c.-motor mounting*

The belt-drive design is furnished as regular unless one of the others is specified, and includes tapping attachment, depth gage, countershaft, belts and power feed, but no table.

The three sizes will drill respectively to the centers of 72-, 84- and 96-in. circles. The maximum distance from the spindle to the base measures 52¾ in. and the minimum distance 15 in. The minimum distance from spindle to column is 10½ in. The spindle is fitted with a No. 3 Morse taper. The travel of the drill head on the arm is 27½ in., 33½ in. and 39½ in. respectively, and of arm on column is 29 inches.

# News of the Week

## Celebrate Centenary of First Steam Railway in England

### *Early equipment and machine tools on exhibition*

The first railway running regularly in England, with steam locomotives for passenger service, was the Stockton and Darlington line on the southern boundary of the county of Durham in England, the formal opening of the service taking place in 1825. The line is now part of the London & North Eastern Railway, and during the first three days of July a program of festivities in commemoration of the centenary was arranged.

A collection of railway relics and modern rolling stock was exhibited at the works of the company at Faverdale, and here on the second day a banquet was held, while on the last day a special luncheon was provided in honor of the delegates to the International Railway Congress. The exhibition items varied in size and consisted of old drawings, paintings, photographs, prints and time tables, relating chiefly to the early history of railway travel, working models of locomotives, and the relics of permanent way material. These included a point plate, run-on plate and crossing from James Outram's Way as used in 1775 in a quarry; from a Yorkshire colliery tramway rails and chairs with stone block sleepers dating from 1809 were shown. Three cast iron fish-bellied rails and chairs from the Stockton & Darlington Railway itself, dated 1825, were shown, and also an original rail and part of a chair from the Liverpool & Manchester Railway.

The development of the railway down to present British standards was exhibited in some detail. Rolling stock, including one or two old Belgian locomotives, was exhibited. The Hetton Colliery locomotive, 1822, Locomotive No. 1, 1825, and the Derwent locomotive, 1845, and a new Garratt-type 2-8-0 + 0-8-2 locomotive built by Beyer, Peacock & Co., Ltd., Manchester, this year, and thought to be the most powerful and also the heaviest locomotive of this type yet constructed afforded interesting contrasts.

Personal items, such as some of the belongings of George Stephenson and Edward Pease, chief promoters, were shown, and objects of interest like a set of fifty-two seals of the various railway companies which were amalgamated into the old North Eastern Railway, now forming part of the London & North Eastern system.

One or two items were of workshop interest—for example, a set of taps used by George Stephenson when making his first (Killingworth) engine. Another Stephenson relic was a handwheel used for driving a lathe by rope. Then in a punching or slotting machine, as used in 1840, the toolhead obtains its motion from the short arm of a rocking lever, the longer arm of which is lifted by means of a crank device. To lift the cutting head the rocking lever falls by its own weight, the rotating shaft acting as the lower stop. A large handwheel and gearing gave motion to this shaft.

The chief item in the celebration was the procession of fifty-three old and new locomotives and rolling stock along part of the line. The procession included the Garratt-type locomotive already referred to; a three-cylinder 2-8-2 locomotive with a booster engine fitted for starting purposes; a 2-2-2 single-driver express passenger engine built in 1847; a 4-2-2 single-driver express engine built in 1899; the first English 6-wheeled coupled bogie engine, 4-6-0, used for express passenger service and built in 1900; a petrol bus converted to rail service; a petrol autocar also for rail service; one or two electric locomotives, and a series of complete trains, mostly new, but including one, with four-wheeled carriages built in 1865. There were several other interesting relics of early days.

## To Study Economic Future of Aircraft

A world economic survey of air transportation, the first to be undertaken in this or any other country, will be carried out jointly by the Department of Commerce and the American Engineering Council, it is announced by Secretary Hoover.

A committee of six, with J. Walter Drake, Assistant Secretary of Commerce, as chairman, has been appointed to direct the work, which will be actively conducted by a field staff, of which Prof. Joseph W. Roe, head of the Department of Industrial Engineering in New York University, vice-chairman of the committee, is director.

The survey, which follows extensive preliminary studies both by the Department of Commerce and the Aircraft Committee of the American Engineering Council, is described as an economic study of civil aviation in the leading nations and a constructive analysis of the economic possibilities of civil aviation in the United States.

The other members of the committee are: Dr. W. F. Durand, president of the American Society of Mechanical Engineers, New York; Prof. E. P. Warner, head of the aëronautical engineering course at the Massachusetts Institute of Techology; Luther K. Bell, Washington, traffic manager of the U. S. Air Mail; C. T. Ludington, Philadelphia, aircraft operator.

The field staff, in addition to Director Roe, will consist of J. Parker Van Zandt, U. S. Air Service, who has recently made an extensive study of civil aviation abroad, and Prof. Alexander Klemin, head of the aëronautical engineering course in New York University.

## Pratt & Whitney to Build Airplane Motors

Aëronautical engines will be manufactured by the Pratt & Whitney Co., in Hartford, Conn., in the plant formerly occupied by the Pope-Hartford automobile factory. Application has been made in Delaware for incorporation of the Pratt & Whitney Aircraft Co., with capital of $2,000,000 preferred stock, $100 par, and 20,000 shares of no par common stock. The aircraft company will be owned jointly by the Pratt & Whitney Co., certain experienced personnel of the aëronautical industry and other important manufacturing interests. The officers are: President, Fred B. Rentschler; vice-president, George J. Mead; secretary and treasurer, E. L. Morgan.

Mr. Rentschler was president of the Wright Aëronautical Corporation. Mr. Mead, who will direct the engineering work of the new company, has had wide engineering experience. He was with the Simplex Automobile Co., and also the Wright-Martin Corporation, as experimental engineer, through the period of the manufacture of the French-Hispano aëronautical engine during the war. He was engineer in charge of power plants for the army air service at McCook Field, Dayton, Ohio. During the past five years he has been chief engineer of the Wright Aëronautical Corporation, and has a splendid record in the development of successful types of aëronautical engines for the strict requirements of military service and commercial use.

Hartford was decided upon for the location of this enterprise because of the splendid manufacturing conditions in that section and the reputation for fine workmanship and experience in precision work possessed by its mechanics. The Pratt & Whitney Co. has been a pioneer in the development and manufacture of machinery, small tools, gages and precision equipment since 1869. The resources of its plant and organization can be utilized to exceptional advantage in the specialized and exacting field of aëronautical engines.

# The Business Barometer

## *This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments*

**By Theodore H. Price**
Editor, *Commerce and Finance, New York*

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IF THE news value of an occurrence is dependent upon the infrequency of such occurrences, then the wage reduction of 10 per cent announced by the New England woolen mills last week is the most important happening recently chronicled.

It is the first substantial cut in the pay of an important group of American industrial workers that has been made for nearly a year. It includes practically all the woolen mills in New England, and it is generally regarded as the precursor of a similar reduction in the cotton mills of the North. Those who have for so long been stressing the need for lower wages as a condition of prosperity see themselves vindicated in the reduction adopted by the woolen mills.

Should the movement for a lower wage scale extend beyond New England the effect upon the purchasing power of our urban population might be serious, but it is too early to generalize about the probabilities, and if the result of the reduction already made shall make it possible to resume full time and increase production in the textile industry it will be a blessing in disguise.

Second only in importance to the wage cut is the sale of an Australian bond issue for $75,000,000. The people of the United States have always felt a peculiar friendliness for Australia, and that may have helped to sell the bonds, which were eagerly taken.

But the success of the offering signifies much more than this, for it means that we are continuing to provide credits here against which our exports of merchandise can be charged if they exceed the imports. Therefore, the bankers who floated the loan have rendered a substantial public service, although it is well to remember that we may not benefit from it if commodity prices here are advanced to a level that checks European buying. In other words, we have reached a point at which, as Sir Esme Howard recently observed, "Trade across the Sea" has become quite as important as "Hands across the Sea."

Upon the theory that our trade across the sea will continue to expand and so bring us increased prosperity at home the stock market was firm early in the week. Later on the tone was somewhat reactionary, but it cannot be said that there was any real weakness, although the ultra-conservatives are urging caution. They point out that as compared with a year ago a representative group of industrial stocks shows an advance of 36 per cent, while the active railway shares are more than 10 per cent higher, that brokers' loans tend to increase instead of decrease, that the interest rate for call money is extremely sensitive to any unusual demand, that the obstacles the Van Sweringen merger is encountering make railway consolidation a hope deferred if not denied, that the bond market is quieter than it has been for months, and that the only basis for a further advance in stocks is a plethora of bank credit, which may disappear suddenly if business revives or we commence to export gold instead of merchandise.

There is no denying the force of the facts thus assembled, and to them might be added the menace of the real estate boom in Florida, which is attracting thousands of tourist investors in midsummer and is said to have partially depopulated some of the cities that are near enough to Florida to feel the pull of the speculation there.

But the very fact that caution is being preached puts most people on their guard and explains the lack of speculative initiative in commodities as well as in securities.

The grain markets are lower as the harvest comes nearer, and it becomes apparent that the world's supply of wheat and other grains is about equal to the world's probable requirements.

The cotton market, as usual, had a convulsion when the Government issued its semi-monthly crop estimate. The presently indicated crop is put at 13,588,000 bales. This is far less than the indicated requirements and the advance established will be fully justified if the Government estimate is right. But this is an important "IF" and there are many who think that the official figures are too low.

Rubber is jumping about eight or ten cents a day, and there is a frenzied speculation in rubber shares in London.

Rice is again firmer, although lower prices are looked for when the new crop begins to move.

The steel industry is a little more active, while the copper market is steady.

Continued activity in building and a large demand for lumber are also indicated by the statistics published, but construction is hampered in New York by trade union conflicts which lead to strikes.

The car loadings are large, the bank clearings continue to run ahead of last year, and conditions are so nearly normal that there would be no reason to expect any lessening of activity if it were not that nearly every one realizes that the sun cannot shine forever.

It may be that this general expectation of a change will avert it, or it may be that people will get what they are looking for simply because they are looking for it. The psychology of the markets has not become a precise science as yet. But, upon the whole, prudence rather than foolhardiness seems advisable when the price level is altitudinous.

### *What's Doing in Industry*

**Machine tool and machinery business continues at a satisfactory level, with slight increases in new orders reported from several industrial centers. The month of July was probably not as good as June, when total sales are compared, but the trend has been decidedly healthy and forecasts a good period of business in the fall.**

**Due to the height of the vacation season many industries have curtailed production. The automotive trade, however, is expanding and has bought quite freely of new tools and shop equipment.**

**Detroit and Cincinnati provide the bright spots in this week's review. The former city, center of the automobile industry, reports increased sales of machine tools; the latter city also renders a satisfactory report of sales and prospects. The New York and the New England districts are holding to a satisfactory level in new orders and in the number of inquries that are expected to bring sure business in the near future. Buffalo is quiet. Canada reports a moderate business, with new inquiries indicating good business activity in the immediate future.**

**General business conditions are good. The fact that caution is being preached has put many people on their guard and probably explains the lack of speculation in markets. No one really expects a slowing up of activity, but prudence instead of foolhardiness is advisable when the price trend is upward.**

# The Industrial Review

## *Progress of the machinery and machine-tool business in various parts of the country*

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

### *New York*

Manufacturers agents and dealers report no appreciable slowing up in the business activity that has been going on in this market for the past few weeks. Orders, though not large, continue to appear in such frequency as to make the outlook most encouraging.

Buying is scattered, practically every class of manufacturer being in the market for some kind of equipment. Railroads have placed some business, but most orders from this source are for individual machines bought accordingly as the necessity arises. The Mobile & Ohio Railroad placed orders with various companies for machine tools, the total value of which has been estimated at $140,000. The C. & O. Railroad and the Monongahela Railways also purchased equipment.

The automotive trade does not often come to this locality to buy, but a few orders were placed in the past week. The Paige-Detroit Motor Co. placed an order with a local firm for 10 deep-hole drilling machines and orders were received from other manufacturers for various kinds of equipment.

Industrials are the most active. Mill supplies are moving well and shop equipment and small tools are in constant demand as the call for general merchandise continues.

The prospects for fall business, which is an absorbing topic of discussion among machine tool dealers right now, are regarded as quite encouraging. General business conditions throughout the country are good and this is taken as a sign that demand for machinery to keep up production schedules will hold up well into the winter months.

### *Buffalo*

The machine tool business here shows no material change over the report indicated two weeks ago. It is pretty generally felt at the present time that July will run somewhat behind June in the volume of business.

Most industries are busy and it is reported that one of the largest industries in the city using machine tools has stepped up its production in one plant by 25 per cent within the last few days.

Machine tool salesmen report in several instances cases of industries that are busy now, whose executives are contemplating purchases of equipment, despite the fact that three months ago the same executives definitely asserted they were out of the market for some time to come. Some decisions are being held up pending the close of the vacation period.

Some small sales have been made in single orders for drilling machines, lathes and the like, although the sentiment is that when the demand becomes marked it will be chiefly for special equipment rather than standard equipment.

Railroads are not in the market here at all.

The demand for small and large cranes as well as paving machinery and other road-building equipment is much slower than in June and earlier in the year but still shows some activity.

One producer of gears and rolls reports business consistently good thus far this year and showing little or no signs of a decline at present.

There is no marked demand for electrical equipment although some small orders for light equipment have been placed. The belief seems general that the fall will bring a good business in all lines.

### *Canada*

Buying of machinery and machine tools in Canada during the last two weeks has been moderate. There is little purchasing being done for future requirements. While business generally is quiet, a good demand is reported for agricultural, power and pulp and paper making machinery and equipment.

Steel mills are beginning to curtail operations. The Algoma Steel Corporation has closed down its rail mill, and the greater part of the Sydney plant of the British Empire Steel Corporation has been closed. A limited amount of business is being done in old material, but warehouses report a steady undercurrent of orders, sufficient to keep things moving.

In Montreal the majority of metal-working plants are operating on part time, with jobbing foundries and machine shops quiet.

The Canadian Car Co. has received an order for fifteen baggage cars from the Canadian Pacific Railway. The Combustion Engineering Corporation, Toronto, has received an order from Price Bros., Ltd., for a steam accumulator, with a volume of 7,500 cu.ft., for the plant at St. John, New Brunswick.

An active program of bridge building in the province of Quebec has resulted in the placing of a fair amount of business with the fabricating shops in Toronto and Montreal. Builders are turning more and more to reinforced concrete, with the result that increasing tonnages of straight and shaped rods are moving.

The car department of the Canadian Pacific Railway, Ogden shops at Calgary, Alberta, has been placed on full time. This means that the men in the car shops will work 44 hours a week instead of 40 hours.

### *New England*

That part of the machinery trade in the New England territory engaged in parts manufacturing for the automobile industry anticipates a temporary let-up in business next month, and continuing until the new car models are settled upon. Aside from this, no halt in the present satisfactory condition of trade is expected and the second half of 1925 should be as good as the first six months.

The consensus of manufacturers is that the first half of this year was the best period in some time. Profit volume showed improvement. The profits, however, were not in proportion to the increased amount of production. Manufacturers report continuance of operations on full time schedules, which they expect to maintain. Recent increases in working forces have brought employment to a peak figure.

Immediate sales are lagging, although better export trade to Germany, Italy and England is reported.

### *Cincinnati*

The majority of machine tool manufacturers in the Cincinnati district report some increase in demand during the past week. In a few cases it has been necessary to increase the number of workers in the production department. Attention is called to the fact that practically all of the skilled workers in the industry are now employed, and there is no longer a surplus.

Export sales are reported to have shown a slight increase in the past week, and the outlook in foreign markets is regarded as decidedly encouraging. The automotive industries have sent in a fair number of orders, and inquiries received indicate that a large amount of buying will follow in the near future.

Railroad orders show a tendency to become both larger and greater in number and there is an increased number of inquiries coming from this source. Miscellaneous orders received are evenly scattered over all sections of the country and are about equally divided in respect to the different classes of tools.

Retailers of machine tools report that they have had some increase of sales during the past week, and although this is slight it is regarded as encouraging. The majority of the retail sales have been for replacement.

Inquiries coming from users of machine tools indicate that many are making plans for expansion.

The feeling in all branches of the machine tool industry is one of encouragement, with the forecast that fall will open up with increased activity.

## *Indianapolis*

Little change is reported in machine tool sales in this district during the last two weeks. Some weak spots have developed in some lines, but other lines have shown increased activity. In the first place there has been an increase in inquiries from woodworking and furniture plants in Indiana.

An increase in machinery sales to coal mines is also reported. This business was not expected, but a number of Indiana mines have resumed operations during the last month and replacements and repairs are general.

Railroad trade in this state is below that of last year. A few shops have been closed, and others are working only on emergency work.

Demand for tools from the automotive industry dropped off a couple of weeks ago and little is expected now until fall. A fair volume continues to come from electric light and power utilities, but traction interests are buying only what is absolutely necessary. Sales to educational institutions continue to be large. Demand for used machinery is slow. However, leaders in the trade here feel that fall will bring better business.

## *Chicago*

Inactivity characterizes the Chicago machine tool industry at this writing, business having declined somewhat during the last week. Machinery men say this is to be expected, however, and that the falling off is only normal for the season. No forecasts are being made with reference to the next few weeks, which cover the regular vacation period. A number of executives are absent from their desks, and a general air of relaxation prevails in the machinery district.

Inquiry among dealers specializing in used machine tools elicits the information that demand for this kind of equipment is quiet, one concern probably the largest handler of used machinery in Chicago, stating that little business is being done in the line of goods it deals in. Other dealers specializing in used machine tools speak of the situation more encouragingly. The Chicago, Milwaukee & St. Paul Railroad is reported as having sent out an additional list of requirements. The Board of Education continues to make inquiry for machine tools needed in the high and tech schools, and within the next two or three weeks is expected to close some worthwhile orders.

## *Detroit*

With sales of machinery and machine tools remaining at practically the same level maintained for some time past, and numerous indications that the leading automobile plants are determined to machine and tool up to peak production by the purchase of new equipment, the outlook for the machine tool industry in Detroit is bright.

Apparently a decision has been reached on the part of several of the larger automotive companies to bring their assembly lines, foundries and other departments up to the fullest efficiency with the latest time-saving devices, as well as considerable of the standard machinery and tools.

Ford's activities continue to expand. The past week has seen the awarding of a contract to the Truscon Steel Co. for the erection of the structural steel in the open-hearth building for the Ford Motor Co. at its River Rouge plant.

The Packard Motor Car Co. is nearing the end of its extensive program of replacing old machinery. Further purchases of equipment are to be expected with the announcement that a new assembly building will be erected.

The Oakland Motor Car Co., of Pontiac, as well as the Buick Motor Co., of Flint, have been machining up for new models soon to be announced.

## Improved Market for American Goods in India

Charles B. Spofford, Jr., American trade commissioner to India, on returning to Washington after three years at Calcutta and Bombay, reports general business conditions in that country as very favorable to American trade.

According to Mr. Spofford, India has been fortunate in having had four favorable *monsoons*, or rainy seasons, in the last four succeeding years, and this has brought prosperity to the country and surplus crops for export at good prices. India is pre-eminently an agricultural country and the result of these favorable monsoons has been the piling up of a visible favorable balance of trade in her favor equivalent to $1,000,000,000. In the past year India's foreign trade showed a favorable balance in merchandise of $500,000,000 on the right side of the ledger.

Further evidence of sound economic conditions in India, according to Mr. Spofford, is indicated from the fact that rupe exchange for dollars has improved by 20 per cent during the past year and now stands at approximately 37 cents as compared with a low of 23 cents and a pre-war normal of 33 cents.

Mr. Spofford emphasized the fact that India ranks among the first seven countries of the world in the aggregate value of its foreign trade. Her exports last year had an approximate value of $1,350,000,000, while the value of India's imports totaled about $850,000,000.

In order to appreciably increase our exports to India, Mr. Spofford emphasized the need for the establishment of direct American sales representation in that country. To employ foreign houses to act as our agents is not going to develop American sales in India to the extent that the possibilities of the market warrant. Some of our American manufacturers might do well to group together and set up an office to sell an allied line of goods by joint representation.

## Dodge Brothers Plan New Manufacturing Units

Dodge Brothers, Inc., of Detroit, has just announced a program of expansion which exceeds anything the Dodge organization has ever before contemplated. A statement issued by the company says in part:

"The largest expansion program in the history of Dodge Brothers is now in progress.

"Continually oversold since the business began, and particularly oversold this year in spite of the fact that production has been consistently in excess of 1,100 cars a day, the management is determined to take extraordinary measures to meet the requirements of its dealers in 1926.

"Five large new buildings are already under construction and three others will begin immediately.

"The total floor area of the eight new buildings will exceed 750,000 sq.ft., and will afford employment for several thousand additional men. The cost of the expansion will be approximately $8,000,000.

"When the present construction program is completed on January 1, 1926, Dodge Brothers, Inc., will have a capacity of 1,500 cars a day. The present intention is to go into full production on this basis the moment the new facilities are available.

"A complete series of new buildings is already under construction on Lynch Road. One building, 75 x 500 ft., will house the heat-treating department; another, also 75 x 500 ft., the heavy hammer shop; another 65 x 500 ft. the light hammer shop. A die shop 100 x 312 ft., will also be erected. To supply power for these new units a large and modern powerhouse will be built. Dozens of new railway tracks are already being laid.

"The new forge department replaces a similar department in the main factory and the buildings which formerly housed it will make way for a five-story building. This building will be for machining and storage purposes. What will be known as main plant No. 4, measuring 75 x 475 ft., will join the machining and storage plant. It will also be five stories.

"When these additions have been made Dodge Brothers' factory will be one of the most compact in the country. The new buildings fit perfectly into the vast system of production."

## Railroad Shops Closed

The Pennsylvania Railroad has ordered the abandonment of its heavy repair shop in Logansport, Ind., on the Marion division. More than 800 men are affected. A number of prominent Logansport citizens left for Philadelphia when the order was made public, to confer with high officials of the company. It is announced that the Pennsylvania company intends doing its heavy repair work at Columbus, Ohio, and at Ft. Wayne, Ind., and men affected at Logansport are offered positions there. This is the second big railroad shop in northern Indiana to be abandoned recently. The Big Four recently closed its shops at Wabash.

# Obituaries

GEORGE DARLING, president of the engineering and foundry business of Darling Bros., Ltd., Montreal, died at his summer home in Hudson Heights on July 16. He was 60 years old.

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At a recent meeting of the board of directors of the Hendey Machine Co., of Torrington, Conn., the following memorial was adopted and was ordered spread upon the minutes:

"We are called upon to record the death of the chairman of our board of directors, the late Frederick Ferdinand Fuessenich. He departed this life in the early morning of Sunday, the 28th day of June, 1925, in his seventy-seventh year; his funeral occurring on June the 30th, the date appointed for the quarterly meeting of the board.

"Mr. Fuessenich became associated with this company in its early beginnings, being one of its first stockholders, and his faith in the enterprise kept him with the company through a time of doubt and discouragement when more mature minds felt that the battle was all but lost.

"His official record with our company runs: Secretary 1883-1889; treasurer 1892-1918; president 1907-1919; chairman of the board 1919-June, 1925.

"In the latter years of his life Mr. Fuessenich was afflicted with failing eyesight, yet this did not diminish his active interest in the every-day affairs of life, the welfare of his children, his many friends and business associates, his church, and Torrington to which he was a generous benefactor."

# Personals

NOAH F. YOUNG, treasurer and general manager of the Lumen Bearing Co., Buffalo, N. Y., was elected president of the organization at a recent special meeting of the board of directors. Mr. Young has been treasurer for five years. He entered the employ of the company nineteen years ago as assistant cashier.

AUGUSTUS A. BOLIK has resigned from the engineering and maintenance department of the Eastman Kodak Co., of Rochester, N. Y., and in October will establish an office in Cleveland where he will engage in mechanical engineering.

T. V. BUCKWALTER, chief engineer of the Timken Roller Bearing Co., of Canton, Ohio, has been elected a vice-president of the company. He has been placed in charge of the entire engineering forces of the organization.

JAMES A. HALL has been appointed professor of mechanical engineering at Brown University.

HENRY A. WOLSDORF has accepted an appointment as assistant professor of mechanical engineering at Robert College, Constantinople, Turkey.

H. H. GLASSIE, member of the Tariff Commission, sailed for Europe on July 15 to make a first-hand investigation of conditions confronted by the investigators of the Commission abroad. He will remain away for about two months.

CLARK A. MINOR has been elected president of the International General Electric Co. He succeeds Anson W. Burchard.

CAPTAIN THEODOR JAKOBSSON, attached to the Royal Ordnance Department of Sweden, was a recent visitor at the Ordnance Office in Washington. Captain Jakobsson furnished the American officials with some interesting and useful data on the mobilization system in use in his country.

J. J. L. ARDIEL, who for the past two years has been assistant sales manager of the Chevrolet Motor Co. of Canada, Ltd., has been appointed general sales manager of the Cadillac Motor Car Co., of Canada, Ltd., and of the Olds Motor Works of Canada, Ltd., subsidiary of the General Motors of Canada, Ltd.

JOHN L. OSGOOD, president of the J. L. Osgood Tool Co., of Buffalo, N. Y., has just returned from Europe. While abroad Mr. Osgood made a survey of the aviation fields and in a recent address in Buffalo he made some interesting comparisons between the stations maintained in this country and those he visited in Europe.

J. C. DAWES has been appointed sales representative for the International Oxygen Co., of Newark, N. J., and will be located at the Pittsburgh office.

L. W. MCCULLOUGH has been appointed to the same capacity in the Toledo office.

WILLIAM T. OBER has been appointed representative of the Thomson Electric Welding Co., of Lynn, Mass., in the Philadelphia district. Mr. Ober has established offices at 2006 Market St.

EDWARD BUSCH has been appointed district manager in Ohio and Indiana for the Hevi Duty Electric Co., of Milwaukee, Wis. Mr. Busch will have a permanent headquarters at 879 Arcade, Cleveland, Ohio.

# Business Items

The New Departure Manufacturing Co., Bristol, Conn., is now operating on a 55-hour weekly schedule and because of production requirements there will be no shut down of the plant for vacation.

The M. P. Dahl Tool and Die Co., of Indianapolis, will move into a new building at Twelfth and Illinois Sts.

The Wilson Foundry and Machine Co., Detroit, a subsidiary of the Willys-Overland Co., has purchased the land, plant and equipment of the Michigan Drop Forge Co., which adjoins the Wilson plant in Pontiac, Mich. The Michigan Drop Forge Co. ceased operations about a year ago. The Wilson Company, makers of engines for Willys-Knight and Overland cars, will use the property for future expansion.

The McKay Motor Co., Ltd., capitalized at $100,000 has been organized to manufacture and deal in automobiles, automobile trucks, aeroplanes, motor boats, motors and engines. Headquarters of the company will be in Ottawa, Ontario.

About half a million dollars damage was done by fire at the Canadian National Railway workshops at Bridgewater, Nova Scotia, on July 15, when several buildings, eight locomotives and eight freight cars were destroyed.

The Wright Water Motor Co., Ltd., has been incorporated in Canada. The company will carry on the business of iron founders, mechanical engineers and manufacturers of water wheels and similar machinery, toolmakers, machinists, etc. Headquarters will be in Toronto, Ontario.

The Globe Machine Co., of Lynn, Mass., announces the removal of its factory from Union St. to 254 Broad St., where larger space has been acquired.

The Vonnegut Hardware Co., of Indianapolis, has purchased the majority stock of the Lilly Hardware Co., and will assume active control of that company.

The E. F. Keating Co., of 452 Water St., New York, has been appointed sales representative in the New York territory for the brass pipe manufactured by the Bridgeport Brass Co., of Bridgeport, Conn.

The Dempsey Furnace Co of Jersey City, N. J., has been consolidated with the W. N. Best Corporation, fuel engineering, of 11 Broadway, New York City. The combined furnace business of the two companies will be operated as the Dempsey Furnace Division of the W. N. Best Corporation.

The Aeronautical Chamber of Commerce of America, Inc., announces the removal of its headquarters to 300 Madison Ave., New York City. The Air Mail Extension Committee will also be located at this new address.

W. A. Fisher, president of the Fisher Body Corporation, has announced the purchase by his company of the Fleetwood Metal Body Co. Mr. Fisher added that the shops of the company would be maintained at Fleetwood as in the past under the direction of Ernst Schebera.

The Fischer Special Manufacturing Co., of Cincinnati, has moved into new quarters at Morgan, Dover and Iowa Sts. New machinery and equipment has been installed to provide for increased production. The Federal Manufacturing Co., of Columbus, Ohio, manufacturer of brass goods, announces the removal of its factory to Marysville, where a large plant has been acquired. At the same time the name of the firm has been changed to the Federal Brass and Manufacturing Co. The personnel of the organization remains the same.

# Pamphlets Received

**Precautions and Safe Practices in the Handling of Acetylene and Oxygen Cylinders.** Published by the Oxweld Acetylene Co., New York, N. Y. This pamphlet is a very useful and concise treatment of what to do and what not to do with welding apparatus. There are sixteen pages of sentence statements on the handling of the cylinders, the setting up of the apparatus and on general safety recommendations.

**Simplified Practice for Terneplate.** Published by the Bureau of Standards, Washington, D. C. Elimination of Waste, paper No. 30, gives the weight recommended by the general conference during October as being 8, 15, 25, 30, 32, and 40 pounds.

**U. S. Government Master Specifications.** Published by the Bureau of Standards. Circular 235, on Rubber packings and gaskets (molded, sheet, and strip). Circular 236, on Cloth insertion ring packing. Circular 239, on Flax packing. Circular 242, on Asbestos Metallic Cloth gaskets. Circular 261, on colored cotton rags for wiping machinery (sterlized). These circulars give the requirements as to grade, material and marking, and the method of inspection.

# Forthcoming Meetings

**American Railway Tool Foremen's Association.** Annual convention, Hotel Sherman, Chicago, Ill., Sept. 2, 3 and 4. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

**International Railway General Foremen's Association.** Annual convention, Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. William Hall, secretary and treasurer, 1061 W. Wabash St., Winona, Minn.

**New Haven Branch of the American Society of Mechanical Engineers.** Fifth annual machine tool exhibition, Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

**Association of Railway Supply Men.** Annual convention and exhibition. Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. Earl E. Thulin, secretary, the Duff Manufacturing Co., 715 People's Gas Bldg., Chicago.

**American Society for Steel Treating.** Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

**Production Meeting Society of Automotive Engineers.** Sept. 14, 15 and 16. In conjunction with American Society for Steel Treating. John Younger, chairman; C. F. Clarkson, secretary, 29 West 39th St., New York City.

**National Safety Council.** Fourteenth annual safety congress, Cleveland, Sept. 28 to Oct. 2. A. A. Mowbray, director, 168 N. Michigan Ave., Chicago.

**American Gear Manufacturers' Association.** Semi-annual meeting, Oct. 1, 2 and 3, West Baden Springs Hotel, West Baden, Ind. T. W. Owen, secretary, 2442 Prospect Ave., Cleveland, Ohio.

**Motor and Accessory Manufacturers' Association.** Fall meeting, Prince Edward Hotel, Montreal, Canada, Oct. 14 to 16. M. L. Heminway, general manager, 250 West 57th St., New York.

**National Industrial Advertisers' Association.** Annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., Oct. 19 to 21. W. A. Wolff, chairman, the Western Electric Co., 195 Broadway, New York.

**Management Week.** Conducted jointly by five societies—The American Society of Mechanical Engineers, The American Management Association, The National Association of Cost Accountants, The Taylor Society and the Society of Industrial Engineers. Week of Oct. 19 to 24. W. L. Conrad, of the A. S. M. E., is chairman of the joint committee.

**American Welding Society.** Exposition of welding equipment and accessories, Massachusetts Institute of Technology, Cambridge, Mass., Oct. 21, 22 and 23. R. L. Browne, chairman, 141 Milk St., Boston, Mass.

# The Weekly Price Guide

## *Rise and Fall of the Market*

**Iron and Steel**—Firmness in fuel and scrap prices serves to balance off the depressing effect of imported pig iron in the local market. Current steel demand is most active in railway material and strips (hot and cold); some signs of firmness are also reported in steel sheets. Bars are holding strongly to the base price of $2 per 100 lb., Pittsburgh. Shapes and plates are a trifle softer; the former at $1.85@$2 and the latter at $1.80@$1.90 per 100 lb., f.o.b. mill.

**Non-Ferrous Materials**—Copper is 1⅛c. per lb. above quotations of a year ago. Tin market shows little activity with prices unchanged. Lead is irregular and about ⅛c. per lb. above July 17 level at New York warehouses. Zinc and antimony markets slower. Belting prices dropped slightly during the past week. Linseed oil is down 2 to 3c. per gal. at important centers.

(All prices as of July 24)

## IRON AND STEEL

**PIG IRON**—Per gross ton, f.o.b.:

| | |
|---|---|
| CINCINNATI | |
| No. 2 Southern | $23.05 |
| Northern Basic | 22.27 |
| Southern Ohio No. 2 | 22.77 |
| NEW YORK—Tidewater Delivery | |
| Southern No. 2 (silicon 2.25@2.75) | 27.37 |
| BIRMINGHAM | |
| No. 2 Foundry | 19.00 |
| PHILADELPHIA | |
| Eastern Pa., No. 2x (silicon 2.25@2.75) | 23.26 |
| Virginia No. 2 | 29.17 |
| Basic | 22.26 |
| Grey Forge | 22.75 |
| CHICAGO | |
| No. 2 Foundry local | 22.00 |
| No. 2 Foundry, Southern (silicon 2.25@2.75) | 25.55 |
| PITTSBURGH, including freight charge ($1.76) from Valley | |
| No. 2 Foundry | 22.77 |
| Basic | 22.77 |
| Bessemer | 22.77 |

**IRON MACHINERY CASTINGS**—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

| | |
|---|---|
| Detroit | 4.75 |
| Cleveland | 4.75@5.00 |
| Cincinnati | 5.00@7.50 |
| New York | 5.00@5.50 |
| Chicago | 5.25@5.75 |

**SHEETS**—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

| Blue Annealed | Pittsburgh Mill Base | New York | Cleveland | Chicago |
|---|---|---|---|---|
| No. 10 | 2.30@2.40 | 3.89 | 3.10 | 3.50 |
| No. 12 | 2.35@2.45 | 3.94 | 3.15 | 3.55 |
| No. 14 | 2.40@2.50 | 3.99 | 3.20 | 3.60 |
| No. 16 | 2.50@2.60 | 4.09 | 3.35 | 3.70 |
| Black | | | | |
| Nos. 17 to 21 | 2.95@3.00 | 4.15 | 3.70 | 3.80 |
| Nos. 22 to 24 | 3.00@3.05 | 4.20 | 3.75 | 3.85 |
| Nos. 25 and 26 | 3.05@3.10 | 4.25 | 4.00 | 3.90 |
| No. 28 | 3.15@3.20 | 4.35 | 4.10 | 4.00 |
| Galvanized | | | | |
| Nos. 10 and 11 | 3.00@3.25 | 4.35 | 4.10 | 4.00 |
| Nos. 12 to 14 | 3.10@3.35 | 4.45 | 4.20 | 4.10 |
| No. 16 | 3.25@3.50 | 4.60 | 4.35 | .... |
| Nos. 17 to 21 | 3.40@3.65 | 4.75 | 4.50 | 4.40 |
| Nos. 22 to 24 | 3.55@3.80 | 4.90 | 4.65 | 4.55 |
| No. 26 | 3.70@3.95 | 5.05 | 4.80 | 4.70 |
| No. 28 | 4.00@4.25 | 5.35 | 5.10 | 5.00 |

**WROUGHT PIPE (Welded)**—Warehouse discounts are as follows:

| | New York Black | New York Galv. | Cleveland Black | Cleveland Galv. | Chicago Black | Chicago Galv. |
|---|---|---|---|---|---|---|
| 1 to 3 in. steel butt welded | 53% | 39% | 55½% | 43½% | 54% | 41% |
| 3½ to 6 in. steel lap welded | 48% | 35% | 53½% | 40½% | 51% | 38% |

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

| Size, Inches | List Price per Foot | Diameters Inches External | Diameters Inches Internal | Thickness Inches |
|---|---|---|---|---|
| 1 | $0.17 | 1.315 | 1.049 | .133 |
| 1¼ | .23 | 1.66 | 1.38 | .14 |
| 1½ | .27½ | 1.9 | 1.61 | .145 |
| 2 | .37 | 2.375 | 2.067 | .154 |
| 2½ | .58½ | 2.875 | 2.469 | .203 |
| 3 | .76½ | 3.5 | 3.068 | .216 |
| 3½ | .92 | 4.0 | 3.548 | .226 |
| 4 | 1.09 | 4.5 | 4.026 | .237 |
| 4½ | 1.27 | 5.0 | 4.506 | .247 |
| 5 | 1.48 | 5.563 | 5.047 | .258 |
| 6 | 1.92 | 6.625 | 6.065 | .28 |

**SEAMLESS STEEL TUBING**—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

| O.D. Inches | List Price per ft. | Differential Discount | O.D. Inches | List Price per ft. | Differential Discount |
|---|---|---|---|---|---|
| ⅛ | $0.09 | 50% | ⅞ | $0.16 | 35% |
| ¼ | .11 | 45% | 1 | .18 | 31% |
| ½ | .14 | 40% | | | |

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

**MISCELLANEOUS**—Warehouse prices in cents per pound in 100-lb. lots:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Open hearth spring steel (base) | 4.50 | .... | 4.@4.65 |
| Spring steel (light) (base) | 7.00 | 6.00 | 6.00 |
| Coppered Bessemer rods (base) | 6.05 | .... | .... |
| Hoop steel | 4.49 | 3.85 | 4.15 |
| Cold rolled strip steel | 6.35 | 8.25 | 6.80 |
| Floor plates | 5.55 | 5.60 | 5.50 |
| Cold drawn shafting or screw | 4.15 | 3.80 | 3.60 |
| Cold drawn flats, squares | 4.65 | 4.30 | 4.10 |
| Structural shapes (base) | 3.34 | 3.20 | 3.10 |
| Soft steel bars (base) | 3.24 | 3.10 | 3.00 |
| Soft steel bar shapes (base) | 3.24 | 3.11 | 3.10 |
| Soft steel bands (base) | 3.99 | 3.20 | 3.65 |
| Tank plates (base) | 3.34 | 3.40 | 3.10 |
| Bar iron (3.00 at mill) | 3.24 | 3.21 | 3.00 |
| Drill rod (from list) | 60% | 55% | 60% |

Electric welding wire, New York, 3/32, 8.25c.; 1/8, 7.85c.; 5/32 to 1/4, 7.35c. per lb. Chicago, 3/32, 8.85c.; 1/16, 7¼c.; 1/8, 7.95c. per lb.

## METALS

Current Prices in Cents Per Pound

| | | | |
|---|---|---|---|
| Copper, electrolytic (up to carlots), New York | | | 14.75 |
| Tin, 5-ton lots, New York | | | 59.00 |
| Lead (up to carlots) E. St. Louis 8.25@8.40 | New York | | 9.00 |
| Zinc (up to carlots) E. St. Louis 7.35 | New York | | 8.25 |

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Antimony (Chinese), ton spot | 18.00 | .... | .... |
| Copper sheets, base | 21.75 | 22.25 | 22.25 |
| Copper wire, base | 19.25 | 21.50 | 20.25 |
| Copper bars, base | 20.87½ | 20.75 | 22.75 |
| Copper tubing, base | 23.75 | 24.75 | 24.25 |
| Brass sheets, base | 18.12½ | 18.62½ | 18.62½ |
| Brass tubing, base | 22.75 | 23.25 | 26.25 |
| Brass rods, base | 15.87½ | 16.37½ | 18.62½ |
| Brass wire, base | 18.62½ | 21.37½ | 20.25 |

# Shop Materials and Supplies

## METALS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Aluminium ingots, 98 to 99%, 1–15 ton lots | 28.00 | 28.00 | 28.03 |
| Zinc sheets (casks) | 11.25 | 11.25 | 10.25 |
| Solder (½ and ½), (case lots) | 39.50 | 37.50 | 40.00 |
| Babbitt metal (83% tin) | 60.00 | 67.50 | 60.00 |
| Babbitt metal (35% tin) | 28.00 | 20.50 | 28.00 |
| Nickel (ingots) f.o.b. refinery | 31.00 | ..... | ..... |
| Nickel (electrolytic) f.o.b. refinery | 38.00 | ..... | ..... |
| Nickel (shot) f.o.b. refinery | 32.00 | ..... | ..... |

**SPECIAL NICKEL AND ALLOYS**—Price in cents per lb., f.o.b. Huntington, W. Va.:

| | |
|---|---|
| Hot rolled nickel sheet (base) | 52.00 |
| Cold rolled nickel sheet (base) | 60.00 |
| Hot rolled rods, Grade "A" (base) | 50.00 |
| Cold drawn rods, Grade "A" (base) | 58.00 |
| Manganese nickel hot rolled rods "E"—low manganese (base) | 54.00 |
| Manganese nickel hot rolled rods "D"—high manganese (base) | 57.00 |

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

| | | | |
|---|---|---|---|
| Shot | 32.00 | Hot rolled rods (base) | 40.00 |
| Blocks | 32.00 | Cold drawn rods (base) | 48.00 |
| Ingots | 38.00 | Hot rolled sheets (base) | 42.00 |
| Cold rolled sheets (base) | | | 50.00 |

**OLD METALS**—Dealers' purchasing prices in cents per pound:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Crucible heavy copper | 11.75@12.00 | 11.50 | 11.25 |
| Copper, heavy, and wire | 11.50@11.75 | 11.25 | 11.00@11.50 |
| Copper, light, and bottoms | 10.25@10.50 | 9.25 | 9.75@10.25 |
| Heavy lead | 6.00@6.25 | 6.25 | 7.00@7.50 |
| Tea lead | 5.00@5.25 | 3.75 | 6.00@6.50 |
| Brass, heavy, yellow | 7.75@8.00 | 6.75 | 7.00@7.50 |
| Brass, heavy, red | 9.25@9.50 | 9.00 | 9.25@9.75 |
| Brass, light | 6.50@6.75 | 5.75 | 7.25@7.75 |
| No. 1 yellow rod turnings | 8.00@8.50 | 7.25 | 7.00@7.50 |
| Zinc | 4.25@4.75 | 3.75 | 4.50@4.75 |

**TIN PLATES**—American Charcoal—Bright—Per box.

| | | New York | Cleveland | Chicago |
|---|---|---|---|---|
| "AAA" Grade: | | | | |
| IC, | 14x20 | $11.25 | $11.45 | $11.50 |
| "A" Grade: | | | | |
| IC, | 14x20 | 8.85 | 9.40 | 9.50 |
| | Coke Plates—Primes. | | | |
| 100-lb., | 14x20 | 6.50 | 6.10 | 7.00 |
| | Terne Plates—Small lots, 8-lb. Coating | | | |
| IC, | 14x20 | 7.25 | 6.95 | 7.50 |

## MISCELLANEOUS

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Cotton waste, white, per lb. | $0.15@0.22 | $0.19 | $0.18 |
| Cotton waste, colored, per lb. | .10@.15½ | .18 | .17 |
| Wiping cloths, 13½x13½, per lb | .17@.17½ | 36.00 per M | .11* |
| Wiping cloths, 13½x20½, per lb. | .... | 45.00 per M | .11* |
| Sal soda, per 100 lb. keg | 2.25 | 2.25 | 2.25 |
| Roll sulphur, per 100 lb. keg | 3.75 | 3.75 | 4.50 |
| Linseed oil, per gal., 5 bbl. lots | 1.01 | 1.14 | 1.01 |
| Lard cutting oil, 25% lard, per gal. | .55 | .50 | .50 |
| Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal. | .35 | .35 | .26 |
| Belting—Present discounts from list in fair quantities (½ doz. rolls). | | | |
| Leather—List price, 24c. per lin. ft. per inch of width for single ply. | | | |
| Medium grade | 40% | 40% | 40% |
| Heavy grade | 30–10% | 30–10% | 30–10% |
| Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft. | | | |
| First grade | 50–5% | 50–10% | .... |
| Second grade | 50–10–5% | 60–5% | .... |

*White, at washery.

## *Comparative Warehouse Prices*

| New York | Unit | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|---|
| Soft steel bars | per lb. | $0.0324 | $0.0324 | $0.0324 |
| Cold finished shafting | per lb. | .0415 | .0415 | .0415 |
| Brass rods | per lb | .1587½ | .1587½ | .14 |
| Solder (½ and ½) | per lb. | .395 | .395 | .3375 |
| Cotton waste | per lb. | .15@.22 | .15@.22 | 14@21 |
| Washers, cast iron (½ in.) | per 100 lb. | 7.00 | 7.00 | 6.50 |
| Emery, disks, cloth, No. 1, 6 in. dia. | per 100 | 3.55 | 3.38 | 3.38 |
| Lard cutting oil | per gal. | .55 | .55 | .55 |
| Machine oil | per gal. | .35 | .35 | .29 |
| Belting, leather, medium | off list | 40% | 30–10% | 40–2½% |
| Machine bolts up to 1x30 in. | off list | 40% | 40% | 50% |

## MISCELLANEOUS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets: | | | |
| Flint paper | $5.46 | $5.84 | $5.00 |
| Emery paper | 10.71 | 11.00 | 11.90 |
| Emery cloth | 29.48 | 31.12 | 32.75 |
| Emery disks, 6 in. dia., No. 1 grade, per 100: | | | |
| Paper | 1.49 | 1.24 | 1.40 |
| Cloth | 3.55 | 2.67 | 3.55 |
| Fire clay, per 100 lb. bag | ..... | .65 | .75 |
| Coke, prompt furnace, Connellsville | per net ton | | 2.85@3.00 |
| Coke, prompt foundry, Connellsville | per net ton | | 4.00@4.50 |
| White lead, dry or in oil | 100 lb. kegs | | New York, 15.75 |
| Red lead, dry | 100 lb. kegs | | New York, 15.75 |
| Red lead, in oil | 100 lb. kegs | | New York, 17.25 |

## SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.60@3.75 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{5}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

# Machine Requirements and Industrial Construction

## Machine Tools and Equipment Wanted

**Calif., Berkeley**—Bd. of Education, G. S. Mouser, Secy., will receive bids until August 4th for No. 2 Norton Universal tool and cutter grinding machine.

**Calif., Merced** — Merced Union High School Dist., H. K. Landram, Clk., will receive bids until August 10th for tools for woodworking and auto shop departments of Livingston Branch High School.

**Fla., Quincy**—The W. P. Kennedy Construction Co.—¾ yard gasoline driven crawler type combination shovel and crane.

**Ill., South Beloit** (Beloit, Wis., P. O.)—Beloit Foundry Co., 308 Gardner St., Beloit—foundry equipment for plant here.

**Ind., Pendleton**—Indiana State Reformatory, A. F. Miles, Supt.—machinery and equipment for machine shops and foundries to replace fire loss.

**Mass., Boston**—Arcade Mfg. Co., 5 Hampden St.—various size power punch presses.

**Mass., Lowell**—T. E. Parker, 142 Chestnut St.—miscellaneous tools and equipment for repair and service garage on East Merrimac St.

**Mass., Roxbury** (Boston P. O.) — M. Rosenfield, 132 Ziegler St.—miscellaneous tools and equipment for repair and service garage.

**Mich., Detroit** — Houstoker Corporation, 226 Mt. Elliott Ave.—20 in. high duty shaper cone or speed box; 22 or 24 in. quick change lathe (used.)

**Mo., St. Louis**—Barth Building & Real Estate Co., 4222 Gravois Ave. — motor driven rip-saw.

**N. Y., Syracause**—Syracuse Fire Door Corporation, 900 Canal St.—120 in. power squaring shear.

**Pa., East Pittsburgh** — Westinghouse Electric & Mfg. Co., Chamber of Commerce Bldg., Pittsburgh—milling machines, small boring mills, sensitive radial drills, small lathes.

**Wis., Madison**—Mead & Seastone, State Journal Bldg.—7½ ton hand operated crane.

**Wis., Milwaukee**—Standard Sheet Metal Works, 1485 30th St.—sheet metal working machinery for plant.

**Wis., Port Washington**—Port Washington Pattern Wks., A. Kuhn, Pur. Agt.—36 in. band saw, planer, joiner, small lathe.

**Que., Ange Gardien**—C. Tremblay—swing saw cut off, belt sander.

**Que., Barraute** — M. Rivard — sander, double angle cut off saw, etc.

**Que., Bearn**—Ouellette & Frere—S. & D. clamp mortiser.

## Opportunities for Future Business

**Ala., Birmingham** — The National Cast Iron Pipe Co., Tarrant City, plans the construction of an office building including pipe shop, etc., at 48th Place and Whipple St. in the Kenwood district. Estimated cost $100,000.

**Calif., Colusa**—Colusa Union High School Dist., will soon receive bids for the construction of a 2 story high school with shop, etc. Estimated cost $200,000. G. C. Sellon, California State Life Bldg., Sacramento, Archt.

**Calif., Los Angeles**—Walker & Eisen, Great Republic Bldg., Archts., are receiving bids for the construction of a 3 and 4 story, 182 x 215 ft. garage and office building at 6th and Loomis Sts., for Union Automobile Insurance Co., Lane Mortgage Bldg. Estimated cost $300,000.

**Calif., Los Angeles**—Wiley Machine Co., 631 East Slauson Ave., has had plans prepared for the construction of 80 x 120 ft. addition to plant on Slauson Ave. Hamm & Grant, Inc., 607 Ferguson Bldg., Archts. and Engrs.

**Calif., Martinez**—American Plywood Co., c/o T. Johnson, Hearst Bldg., San Francisco, plans the construction of a factory here. Estimated cost $40,000.

**Calif., South San Francisco** — Western Pipe & Steel Co. of California, 444 Market St., San Francisco, is having plans prepared for the construction of new mills here. Estimated cost $1,000,000. W. W. Breite, 601 Clunie Bldg., San Francisco, Archt.

**Conn., Middletown**—Noiseless-Remington Co., North Main St., awarded contract for the construction of a 2 story, 50 x 250 ft. plant on North Main St. Estimated cost $100,000.

**Ill., Bush**—Missouri Pacific Railroad, Railway Exchange Bldg., St. Louis, Mo., awarded contract for the construction of a machine shop here. Estimated cost $25,000.

**Ill., South Beloit** (Beloit, Wis., P. O.)—Beloit Foundry Co., 308 Gardner St., Beloit, awarded contract for the construction of an 86 x 180 ft. foundry here. Estimated cost $40,000.

**Ind., Lafayette**—Standard Woodworking Co., plans the construction of a 1 story, 66 x 132 ft. woodworking plant. Estimated cost $40,000. L. L. Johnson, Attica, Archt.

**Ind., Pendleton**—Indiana State Reformatory, A. F. Miles, Supt., plans the construction of machine shops and foundries to replace fire loss. Estimated cost $50,000.

**Ia., Sioux City**—Illinois Central Railroad, 135 East 11th St., Chicago, Ill., awarded contract for the construction of a 1 and 2 story terminal building including a machine shop, round house, etc. Estimated cost $700,000.

**Kan., Kansas City**—H. N. Strait Mfg. Co., Adams & Shawnee Sts., plans the reconstruction of 75 x 215 ft. foundry at Adams and Shawnee Sts., to replace fire loss. Estimated cost $50,000. Architect not selected.

**Kan., Leavenworth** — A. T. Evans will build a 1 story, 56 x 100 and 36 x 75 ft. machine shop by day labor. R. W. Watson, Telephone Bldg., Archt.

**La., De Queen**—The Gulf Coast Lines, Union Station, Houston, Tex., will build a 38 x 306 ft. iron car repair shop, 140 x 170 ft. metal machine shop, etc., here, by day labor. C. S. Kirkpatrick, 2405 Yupon Drive, Ch. Engr.

**Md., Hagerstown**—M. P. Moeller Organ Works, has had plans prepared for the construction of a 3 story, 60 x 140 ft. factory and 2 story, 40 x 80 ft. office building. Estimated cost $150,000. J. E. Moxley, 20 East Lexington St., Baltimore, Archt.

**Mass., Boston**—Bd. Educ. plans the construction of a 2 story West End District School, including manual training and manufacturing rooms. $400,000. J. M. Gray, 175 High St., Archt. Walker, Walker & Kingsbury, 120 Boylston St., Associate Archts.

**Mass., Boston**—L. S. Kaufman, 43 Tremont St., is receiving bids for the construction of a 2 story, 100 x 300 ft. garage at Lehigh and Albany Sts. Estimated cost $200,000. G. N. Jacobs, 4 Park St., Archt. Noted July 23.

**Mass., Boston**—T. J. Moynahan Jr., and A. Erlandson, 59 Carver St., are having plans prepared for the construction of a 2 story, 140 x 290 ft. garage at 210 Albany St. Estimated cost $250,000. G. N. Jacobs, 4 Park St., Archt.

**Mass., Charlestown** (Boston P. O.)—L. Page, 469 Rutherford Ave., awarded contract for the construction of a 1 story, 80 x 100 ft. repair and service garage on Rutherford Ave. Estimated cost $40,000.

**Mass., Chelsea** (Boston P. O.)—Francis & Badger Motor Co., 279 Broadway, is receiving bids for the construction of a 1 story repair and service garage at Carson St. and Broadway. Estimated cost $50,000. Private plans. Noted July 9.

**Mass., Dorchester** (Boston P. O.)—James Russell Boiler Works, 9 Dewar St., awarded contract for the construction of a 1 story addition to boiler works on Dewar St. Estimated cost $40,000. Noted July 9.

**Mass., Sommerville** (Boston P. O.)—Ford Motor Co., Woodward Ave., Highland Park, Mich., will receive bids until August 3rd for the construction of a 1 and 2 story, 301 x 1,130 ft. assembly plant on Middlesex Ave. here. A. Kahn, 1000 Marquette Bldg., Detroit, Mich., Archt. Noted July 9.

**N. J., Newark**—J. S. Mundy Hoisting Engine Co., C. L. Mundy, Pres., 722 Frelinghuysen Ave., plans the construction of a 2 story, 40 x 140 ft. plant including a machine shop, pattern shop, etc.

**N. Y., New York** — Watkins Garage Realty Co., Inc., c/o M. Klein, 39 Graham Ave., Brooklyn, Archt., is having plans prepared for the construction of a 4 story garage on Lexington Ave. Estimated cost $160,000.

**O., Canton**—Peerless Auto Sales Co., 421 Cleveland Ave. N., awarded contract for the construction of a 2 story garage on Walnut Ave. N. W. Estimated cost $150,000. Noted May 14.

**O., Cleveland**—J. Rutkowski, 6600 Park Ave., has had plans prepared for the construction of a 75 x 120 ft. structural steel and iron work foundry at 6507 Sidaway Ave. Estimated cost $40,000. Private plans.

**O., Youngstown**—Youngstown Foundry & Machine Co., 365 East Boardman St., plans the construction of a 1 story, 120 x 260 ft. addition to plant on Poland Ave. Estimated cost $200,000.

**Okla., Blackwell** — Murdock Motor Co., Ponca City, plans the construction of a garage and factory building, here. $55,000. Architect not selected.

**Pa., Linhart**—B. H. Prack, Martin Bldg., Pittsburgh, Engr., is receiving bids for the construction of a 3 story, 100 x 506 ft. brass foundry, here, for Westinghouse Electric & Mfg. Co., East Pittsburgh. Estimated cost $45,000. Engineer will award separate contracts.

**Pa., Pittsburgh**—Pittsburgh Parking Co., Inc., c/o Mellon Stuart Co., Oliver Bldg., is having plans prepared for the construction of a 9 story, 120 x 147 ft. and 6 story, 90 x 180 ft. garage at 5th and Wylie Aves. and Pennsylvania Ave. and Evans Way. Estimated cost $400.000 and $200,000 respectively. Private plans.

**R. I., Providence**—Providence Gas Co., Turks Head Bldg., will soon award contract for the construction of a 2 and 3 story, 200 x 300 ft. garage, shop and storage building. Jenks & Ballou, 1035 Grosvenor Bldg., Boston, Mass., Archts.

**Tex., Dallas**—Perry Motor Co., 615 Good St., lessee, will soon award contract for the construction of a 3 story garage on Pacific Ave. Estimated cost $150,000. F. F. & C. F. Peterman, 1005 Merchantile Bldg., Archts.

**Wis., Milwaukee** — International Harvester Co., 217 Oregon St., is receiving bids for the construction of a 1 story, 80 x 120 ft. service building on Reed St. Estimated cost $50,000. Private plans.

**Wis., Milwaukee**—Standard Sheet Metal Works, 1485 30th St., awarded contract for the construction of a 76 x 120 ft. plant on 30th St. Estimated cost $40,000. Noted Mar. 12.

**Wis., Oshkosh**—Oshkosh Auto Specialty Co., Forest Ave., awarded contract for the construction of a 50 x 146 ft. plant for the manufacture of fender braces, auto jacks, etc. Estimated cost $40,000.

**Wis., Racine** — Standard Foundry Co., 1600 Kewnaunee St., awarded contract for the construction of a 1 story, 90 x 220 ft. foundry as first unit for core room.

**Que., Thurso** — Singer Mfg. Co., Ltd., awarded contract for the construction of a factory building. Noted Jan. 29.